North Carolina Highway Bulletin

VOL. IV JUNE, 1923 NO. 4

SCENE ON ROUTE NO. 10—ALAMANCE COUNTY

Report of Inspection of

A PERMANENT CULVERT

Installed ten years ago.

Time has tested this Armco Culvert and its permanence is established.

GUILFORD COUNTY
Greensboro, N, C.
July, 5, 1922.

SUPERINTENDENT OF ROADS.

The Dixie Culvert & Metal Company,
Atlanta, Ga.

Gentlemen:-

The 60" Corrugated Armco Culvert, 20 ft. long, installed on the Huffine Road is today in splendid condition.

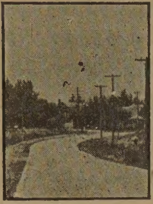
We are just now widening this road to a considerable extent and this pipe is being left in place, but some additional corrugated culvert has been ordered to piece out this old pipe so it will be long enough to carry the new fill.

Truly yours,
(Signed) J. G. Foushee, Road Supt.

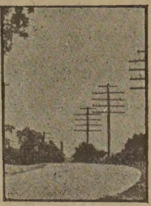
THE DIXIE CULVERT & METAL COMPANY
ATLANTA, GEORGIA

J. G. BALDWIN,
ASHEVILLE, N. C.

W. H. McNEILL,
LAKEVIEW, N. C.



NORTH CAROLINA
HIGHWAY BULLETIN



VOL. IV, NO. 4 **H. K. WITHERSPOON, Editor** **JUNE, 1923**

Bridge Maintenance

By E. A. Adams, Jr., *Assistant to Bridge Superintendent*

ONE of the most important branches of the State Highway Commission is that of bridge maintenance. When the Commission assumed control of the roads comprising the State Highway System a large number of the bridges were in a rundown condition and in some cases required complete reconstruction. To care for this condition inspection of the various bridges of the State was begun with a view to securing data on every bridge in the State for filing in the office of the Senior Bridge Engineer at Raleigh. The form which is filled out, and which will be described later, gives a complete record of the bridge as it is at the time of the inspection and includes recommendations for the repairs needed. It is surprising to know that there are scores of bridges throughout the State, built before the days of State Highway work, of which there are no plans or records of any kind and in a number of cases not even the builder's name can be ascertained. This necessitated making complete measurements of the bridges so that the records of the Commission might be made complete for future reference.

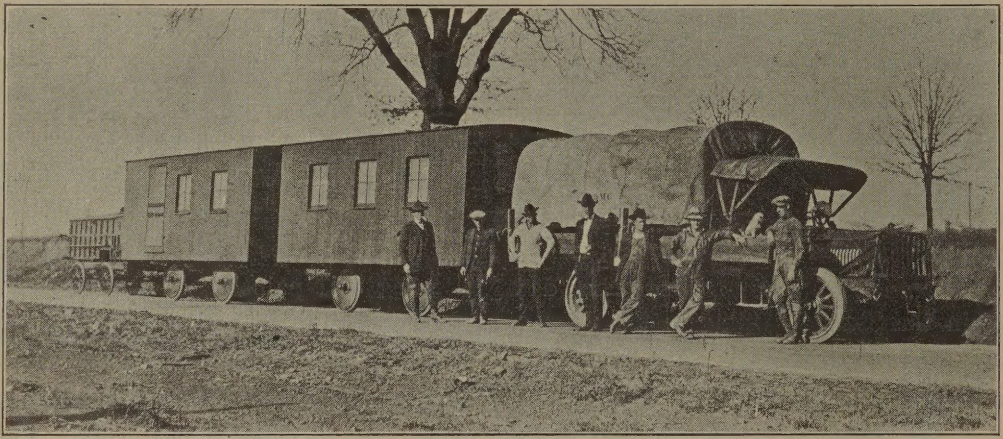
The matter of organization to take care of the maintenance and repair of the bridges mentioned above is handled in two ways. In each district, under the supervision of the District Maintenance Engineer, there is a bridge maintenance force with equipment to take care of small repairs, such as patching floors and railings, or perhaps reflooring entirely small bridges, and cleaning and painting. These gangs are housed in quarters mounted on ex-army trailers, as shown in the photograph and live on the job. In addition to the various "district gangs" there are several bridge gangs throughout the State equipped to do heavier work of various kinds as completely reconstructing a large bridge and cleaning and painting it by compressed air. These gangs are under the supervision of the Bridge Engineer of the State Highway Commission and are directly in charge of an experienced bridge man. The work of these gangs is in no way intended to replace that of the district gangs but rather to supplement this work. They are equipped with all tools and machinery (necessary) to handle large jobs quickly and economically. Examples of the work done by these forces include the reconstruction of the bridge over the Neuse at New Bern, the machine cleaning and painting of the bridge over the Yadkin River near Advance and the reconstruction of the bridge at Washington. The latter also serves as another example of the work of these gangs, namely, in an emergency. As described in last month's **Bulletin** this bridge gave way under an excessive load. One of these gangs working nearby was immediately transferred to the scene and before 11 o'clock the following morning traffic was passing over the bridge on a temporary crossing. A pile driver was moved from another job, set up, piles driven around the sunken piles, the bridge jacked up and repaired and is today none the worse for the collapse. These are only a few of the many different pieces of work done by this organization.

Naturally everyone wants to know where the money comes from to pay for this work. As this article is being read thousands of applications for automobile licenses are being received in the office of the Motor Supervisor of the Secretary of State's office; in one corner of the Supervisor's office sits a man who receives checks for the tax of three cents per gallon on gasoline which is used in motor vehicles. During the year just passed the combined revenue from these sources amounted to $3,728,000. These figures are based on a tax of one cent per gallon on gasoline. This tax was increased to three cents by the General Assembly of 1923, and it is anticipated that approximately $6,000,000 will be collected from all sources this year. After deducting $250,000 for the operating expenses of the Commission, a sinking fund of $250,000 for the bonds authorized for road construction, the interest on the bonds, and the operating expenses of the Motor Supervisor's office, the remainder is applied to the maintenance of the roads and bridges making up the State Highway System of something like 6,100 miles. Thus it will be seen that the burden of keeping up the roads and bridges is properly placed on the owners of motor vehicles, those who actually use the roads and derive benefit therefrom.

As has been previously stated, the records regarding the bridges taken over by the State are lacking in the majority of instances and for this reason it is necessary that records be compiled. To do this it is necessary to make a preliminary inspection and sometimes actual measurements and an annual inspection to insure that the bridge is kept in condition for traffic. To make the records complete three forms are used: (a) Inspection Report of Existing Structure; (b) Annual Bridge and Culvert Inspection Report; (c) Bridge and Culvert Inspection Record.

The first mentioned form is just what the name signifies, an "Inspection Report of Existing Structure." It is made up of a double fold letter-size sheet, four pages in all, providing for everything that should be known about the job. The inside of the form is a cross-section sheet so that a sketch of the existing structure can be made, and this is done in every case where shop plans are not available. On the outside (front and back), spaces are provided for showing the location of the bridge, the number, name of stream which it spans, name of nearest towns and railroads, and type of road on which located. This is followed by spaces for data pertaining to the design of the bridge proper. Finally, space is allotted for the recommendations of the inspecting engineer as to the necessary repair work and the condition of various members. This report becomes the basis for all subsequent data and operation as well as a permanent office record for every bridge in the State.

The next step, so far as records are concerned, is that of the Annual Inspection. Proper maintenance requires that bridges be kept in good condition, and to this end an annual inspection is made and reported on the second form (b). This sheet fits a pocket-size loose leaf notebook and can be conveniently carried from bridge to bridge. Space is provided for showing district number, route number and bridge number and also for making report of the condition of the several parts of the bridge. Abutments and wingwalls, piers and bents, trusses, floor, stringers, handrail, and in fact all parts are examined and reported on. Consideration is given to the present waterway; is it sufficient under existing conditions? Finally, recommendations as to painting and repairing are given by the inspector, all of which is done on the Annual Inspection Report form.


Bridge Maintenance Gang and Their Quarters

The third form (c), known as "Bridge and Culvert Inspection Record," is purely an office record of a bridge and covers a period of five years. That is, space is provided for entering the "Annual Inspection Report" over a period of five years. It is, therefore, a summary and a comparison. The record form is letter-size and printed on cardboard for ease in handling. Space is provided for a detailed description of the bridge so that all vital facts are shown without the necessity of reference to other records, district, route, and bridge number; bridge and stream name; type of bridge, material, skew, roadway, total span, number spans and length of each, average under-clearance, stringers, handrail, floor, abutments and wingwalls; all are shown in complete form on the front. On the back there are five spaces for entry of the annual inspection reports as they are made from the field. Whenever at any time there is a question as to the useful life, strength, or general condition of a bridge, this card form will furnish the latest available data.

In following articles the field operations and methods used in cost accounting will be taken up.

FRANK PAGE

Gentleman—Banker—Soldier—Road Builder

WHEN Frank Page was elected president of the American Road Builders' Association recently, many asked "Who is Frank Page?"

The situation is similar to that which arose in June, 1920, when the question flashed across the country, "Who is Harding?"

Both men had quietly been preparing for the big jobs which they were to undertake. Before the year is out the road builders of the country will find that the head of their national organization is a strong, courageous, well-trained man, who, as chairman of the North Carolina State Highway Commission, has put that State at the top of the list in highway progress.

Frank Page was to the manor born. He comes from a family that has furnished notable men for generations. One of his brothers was the late Walter Hines Page, Ambassador to Great Britain during the war, and prior to that one of the leading publishers of this country. Another brother was in Congress for twenty years. A third brother is at the head of a chain of banks and trust companies in the South with which Frank Page himself is connected.

Other members of the family have achieved success in various other lines. Doing big things well, therefore, is a tradition in the Page family.

Not long after leaving college, Frank Page tackled the job of making a paying proposition out of a short-line railroad that was controlled by his family. He did this job so well that the line was sold to one of the trunk lines of which it is now an important link. Frank Page also had extensive experience in lumbering operations before he devoted practically all of his time to the banking business.

Soon after the war broke out Frank Page enlisted in the army, although he had two boys old enough to go and one of them died in service in France. Frank Page was offered a job getting out lumber in the West, but he felt that others could do that, and asked to be sent right to the front. As a result, he was soon in France, where he saw service through much of the war as a major in charge of troop train operation. Those who were across know that such an assignment is not exactly a bomb-proof, swivel-chair job.

One incident of his military experience illustrates how loyal an organization can be to Frank Page. His regiment was outlawed for cause. In spite of the fact that nearly every man in the outfit had had his pay taken from him, the regiment gave Frank Page a silver service as their appreciation of his leadership of them.

After his return home Frank Page settled down to business again. Meanwhile the demand for better roads had become universal in North Carolina. The State had done some highway work, but there was little money and practically no organization available. Local politics also determined when and how most of the roads should be built. Log rolling was accepted as good practice by every politician in the State.

The time was ripe for the great change that occurred in highway affairs in North Carolina. The State Legislature passed a $50,000,000 bond issue, along with a law creating a State Highway Commission. That law has proved in practice to be the model that it was intended. It gave the State Highway Commission powers which had never before been conferred on any State organization. It made possible the removal of the highway affairs of the State from politics. But legislation could not make the man to execute successfully such a law.

Fortunately, about the time the North Carolina State Highway legislation was in the making, Frank Page was suggested to the Governor as the most logical man to be chairman of the commission. He had never been in politics and was known in his State solely as a business man. The Governor knew, however, that it was vital to put at the head of the commission a strong man who would administer the law courageously and fearlessly. He believed that Frank Page met the specifications. The record that Frank Page has made as chairman of the North Carolina State Highway Commission has fully justified the Governor's judgment.

When Frank Page undertook in 1920 to spend $50,000,000 on highway work in North Carolina, the State had practically no organization. No local sources of sand, gravel and broken stone suitable for surfacing had been developed. Few contractors in that section of the South had ever built a modern road. A very limited mileage of second-class road had been constructed in the State. The State and the counties also had maintained partially a very small percentage of the highways of the State.

Working quietly in his determined way, Frank Page built, in a very few months, an organization that soon began to make highway history. One of his first moves was to induce C. M. Upham to leave Delaware to become State Highway Engineer of North Carolina. Frank Page soon saw that Upham could quickly and thoroughly organize the necessary engineering force and could

(Continued on page 14)

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Address all communications in regard to BULLETIN to the Editor, Box 1140, Raleigh, N. C.

This BULLETIN will be sent gratis to any State or county official, contractor, newspaper, trade publication, library, or other person interested in the improvement of roads and in the work of the Commission. Advertising rates may be obtained on application.

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Editorial

Auto Clubs should call to the attention of their members the law which goes into effect on July 1st requiring motorists to stop at all grade crossings except those in cities and towns.

In spite of labor conditions a number of contractors are expected to bid on the projects to be let on June 27th. The names of the successful bidders will be published in the July issue.

The Editor desires to thank the Resident Engineers in the First, Fourth and Seventh Districts for the interesting descriptions of their various projects. Some of these are printed in this issue while others will appear next month.

In a series of articles, the first of which appears in this issue, the operations, both in the field and office of the Bridge Maintenance Department, will be described. This work is of great importance in the general maintenance scheme in the State and the methods used will be interesting.

North Carolina has the unique distinction of having a "Doctor of Laws" at the head of the State Highway Commission, this degree having recently been conferred on Chairman Frank Page by his Alma Mater, the University of North Carolina. As is characteristic, Mr. Page gives the credit to the men of the organization. The entire organization feels a distinct sense of pride in the honor that has been bestowed on our leader, under whose capable guidance North Carolina has attained a high standing in highway work. Mr. S. T. Henry, of "Successful Methods" is the author of a very interesting sketch of Mr. Page's life, which is reprinted on page 5. While this organization has never been outlawed, as was his regiment in France, it is every bit as loyal to him.

Project 781-Wilkes County Presents Difficulties

By H. T. Brown, *Resident Engineer*

IN accordance with the general custom of connecting the county seats by a highway, the progressive citizens of Wilkesboro, the county seat of Wilkes County, and those of Jefferson, the county seat of Ashe County, in 1905 built a road connecting the two towns, officially known as the Jefferson Turnpike. Just how the latter nomenclature was applicable to this road the writer has never discovered unless it be that toll was charged for traveling over same.

Conditions Encountered Along Route

This road was built by private subscription, hiring free labor and also with convicts furnished by the State. The location, route and alignment were fairly good considering the innumerable difficulties encountered. The construction, however, was of a very temporary nature, without any drainage or other necessary provisisions for permanent wearing qualities.

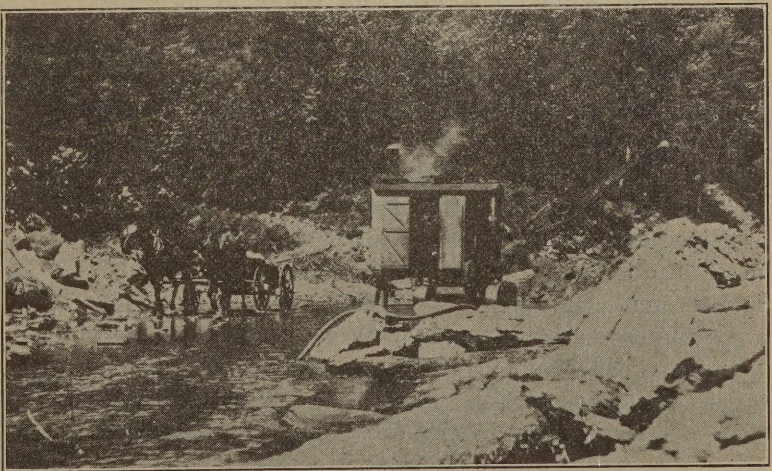
The route selected was the only feasible one, namely, that provided by nature, as Reddies River has its source near the top of the Blue Ridge Mountains in a gap in line between the two towns, and empties into the Yadkin River at Wilkesboro. The road therefore follows Reddies River and its tributaries almost to its very source.

In July, 1916, there occurred one of the most phenomenal floods in this section known to the weather bureau, the rainfall being something over three inches in less than three hohrs. the result of this extraordinary downpour was the absolute obliteration of this road from the Ashe County line to North Wilkesboro, rendering same impassable for vehicles over the entire line, a distance of approximately eighteen miles, and distance, some portions of the road being also impassable for horseback traffic, and in many instances there was nothing left but a rock buff around which it was impossible for the engineering corps to get except by the aid of ropes and ladders.

Before beginning construction that portion of the road from Wilkesboro to the Whittington settlement at the foot of the first range of mountains was abandoned and the road routed via the ridge road and Miller's Creek, diverging from the Boone Trail at Miller's Creek. Project 781 begins at the upper end of the portion abandoned and extends to the Ashe County involves the reconstruction of the old turnpike above referred to.

In this connection the word reconstruction is used simply to designate the fact that practically the same route and location is to be followed and nothing more as the project is really a construction of the road instead of a reconstruction, and involves what the writer has been told is the heaviest construction in the State, having in many instances to negotiate rock cliffs as high as sixty-five feet from the grade line to the upper slope stake, which cliffs consist of a very difficult rock to handle, there being practically no defined strata, no homogeneity whatever, often encountering a dozen different classes of rock in as many feet; in other words, the common adage that North Carolina is the geologist's paradise is well demonstrated in the rock cliffs encountered on the project.

The first five miles of this road traverses a fairly good agricultural section, consisting of river bottoms, After crossing the watershed between the east and north forks, through a deep cut, the valley narrows very abruptly and rock cliffs begin to be encountered. At approximately the seventh milepost the first gorge is entered and the heavy work proper begins. For the next three miles it is a case of dynamite and steel followed by steam-shovels and teams.



Hauling Material Out of River for Fills

After emerging from the first gorge the second small valley is encountered, corresponding to the first step or plateau found in crossing the Blue Ridge further west. After traversing this valley for about one-half mile, the second gorge is entered and the work is more difficult than the first gorge, as the grade is steeper and the nature of the rock changes as it is found to be in layers similar to the shingles on a roof; the slope of which would be ¾ to 1. Such a formation is very difficult to handle, due to the fact that it is very susceptible to slides. Upon two occasions fatal accidents were very narrowly averted by this rock sliding in on the steam shovel. It was found necessary at such places to strip these cliffs very much further back than necessary for the proper width of the road on account of the imminent danger to traffic. Fortunately there are several bridges near this location, and the rocks were used in the abutments.

The accompanying photographs are intended to show some of these treacherous cliffs. In order to avoid these dangerous cliffs and slides the road and the course of the river were moved to the opposite side of the gorge, the river being lowered and the material from the river bottom used to make a fill for the road. In the second gorge there are therefore three river changes and three fills, each consisting of approximately 2,000 yards.

To avoid impregnable cliffs it was found necessary to cross and recross the river, necessitating five bridges in the second gorge. Having encountered nothing but rock, it was naturally assumed that there would be no difficulty in finding solid rock foundations for the abutments of these bridges and ample material for the economical construction of same, but alas, we found the rock was where we did **not** want it and not where we **did** want it, and the sand and gravel proved to be a snare and a delusion when the Testing Department got hold of it, so we could do nothing but complain at Dame Nature's eccentricities.

Under the above conditions we are compelled to import sand and haul same twenty-five miles, and to select and hand-pick rock for concrete. On account of the fact that in several of the cliffs we found natural rock shaped to a mathematical exactness, some of the samples not varying more than 2% from a perfect square, it was decided to build the abutments of cement ruble-masonry and we were congratulating ourselves upon what a snap we would have and the pretty pictures that we would get and the Chief would give us upon our fine abutments. Again we reckoned without our host. While this rock is perfect by nature in **one** direction, it is absolutely impossible to cut it, saw it, blast it or break it in anything like a square joint and we were compelled to substitute another class of rock that we are able to work to some extent.

At the head of the second gorge the mountain proper is encountered and the winding, circuitous route begins. Unlike the approach and crossing of the Blue Ridge further west, we have no first step or plateau as the rise from the edge of the first gorge is very abrupt, as will be seen from the following example: The air line horizontal distance from station 96 to station 230 is only 3,000 feet; the vertical distance is 700 feet. The vertical distance or difference in elevation, station 115 to 64, is 302 feet and the slope stakes overlap.

From the best information the writer has, this road has one of the best grades of any road crossing the Blue Ridge, as it only exceeds 6% for a very short distance, the average grade being about 5%. The curves, however, while they are within the specified limits, are very numerous, as is evidenced by the fact that a tangent can be so located with reference to the road that it will intersect the center line fourteen times within a distance something over a mile. Furthermore the contour of the mountainside is extremely unfavorable for road location, it being very profusely corrugated. This adds very materially to the difficulties of alignment and looks as well as the annoyance in driving.

As is well known, drainage is absolutely essential to the life of a mountain road; in fact a great deal more so than in the case of the road in the more level country In the latter case if the drainage is deficient the road is still there in the form of a mudhole and can be traveled. In the case of the mountain road, however, if the drainage is not effective there will be no road left to travel. This is due to the fact that the top of the mountain is cleared and under cultivation. It is, however, very steep and the runoff is practically equal to the rainfall, as we found out by sad experience. In two instances we installed a pipe, the carrying capacity of which was based upon the drainage area, the theoretical runoff and the ordinary calculations involved in determining same, we found that Nature has a formula differing from "book-larning," as the natives call our engineering qualifications, and as a result we found quite a large gully along side of the pipe. In this safe connection we are keeping this characteristic constantly before us in the designing of the bridges as the river in the second gorge we have seen to rise as much as five feet in thirty minutes.

At the present writing we have practically ten miles of this road gravelled. At first sight the gravel we are using would not be acceptable to the casual observer on account of the high percentage of mica, etc., which it contains. We have found out, however, that there are quite a number of gravel pockets along the river in whiich the gravel is mixed with a low grade of iron oxide and we have endeavored to use this with what is promising to be very good results.

As is well known, any surfacing material is serviceable in proportion to its specific gravity, first; and second, to its binding qualities. The available surfacing material in this section has a high specific gravity but a low binding coefficient.

We hope to have this road open to traffic by the early fall, and while we do not claim any geysers, glaciers, mountain lions, etc., we think that we are justified in recommending this route to the tourist whose patriotism prompts him to see North Carolina first and especially Wilkes and Ashe counties.

The Finest Road *in the* World—*and* What *it* Leads To

PRIDE of ownership in the property of a community is no less strong a sentiment than pride of ownership in the property of an individual.

Extravagance in public expenditure is quite as observable as it is in private expenditure, and it is usually put across by the same kind of emotional appeal that is so effective in selling things to the individual.

The same psychology that works in selling silk shirts or socks to the working man who would find linen, wool or cotton much more practicable and economical, will work in selling to a community an expensive type of road construction, when a less costly type would be of equal service and, from every practical standpoint, a much better buy.

A good many thoughtful men are beginning to question whether in the intensive and constantly accelerating campaign for good roads which has been so consistently and properly maintained in this country during the past generation the American public has not unconsciously lost sight of some of the fundamental and practical problems involved in the securing of road service.

With the constant education of the public which has been going on, the expenditures for highway construction and maintenance have been growing by leaps and bounds, until such construction today is one of the most important activities in the country, considering, as a whole, the expenditures of the nation, the States and the local communities.

Yet, in spite of this enormous activity and the tremendous accomplishments that have resulted from it, we have only faintly approximated the necessities of the situation.

Competent authorities have estimated and have put before the public statements to the effect that the present day requirements of improved roadways in this country, considering only the general service of the whole public and without including strictly local service, aggregate the enormous total of 2,300,000 miles of roads. Of this tremendous aggregate, according to the same authorities, all of the road building efforts of the country up to date have succeeded in providing for a mileage, completed or under construction, of something less than 100,000 miles.

In other words, the total improved road mileage of the country as it stands is something less than five per cent of the amount that the present necessities of the country demand.

It is universally admitted that this is a real and present need. That the construction and maintenance of good roads to approximately the extent indicated by the figures given above is one of the most important essentials to the growth, progress and prosperity of the country. That, if by some magic, the completion of this great program could be accomplished over night, such a result would be of greater service to the nation than almost any other one thing that can be imagined.

Unfortunately, in the accomplishment of this great work there can be no magic. It must be brought about as all serviceable results are brought about, by good management and the expenditure of much labor and money.

It is, however, a grave question whether community pride, by demanding expensive types of road construction because of community pride, is not thereby greatly slowing up the fulfillment of our real needs. There is a limit at any given time to the taxable resources of a State or of a community, just as there is to the resources of an individual. And it is certainly as practical for the community, as for the individual, to ask itself the question whether it is not wiser to have plenty of good, wholesome bread than to have a limited supply of cake. Whether it is not better to have three good, serviceable linen or cotton shirts than to have one of silk.

Is it not better to have three miles of good, serviceable highways that will carry the traffic smoothly and durably, rather than one mile which will give no better practical service to traffic, but which can be pointed to by the community in pride as the best type of road in the world?

As a matter of fact, the public conception of road quality is largely limited to a comparison of the qualities of differing road surfaces. The public rarely looks below the surface. Yet the engineer, or the man who has given any study to the subject at all, knows that the most important qualities of a road are in its foundation and substructure, and particularly and above all, in connection with the methods used for its drainage, methods to keep moisture out of its foundation and off is surface. It is because of this all-important question of drainage that the question of the correct and economic use of culverts and culvert materials is so important a part of road construction.

Is it not time for the road building community to begin to ask how much serviceable, good road mileage, well drained, with a strong and durable foundation and a smooth riding surface that can be maintained for a reasonable expenditure, can be built and kept up for the taxable resources of the community, and to demand that road expenditures be devoted to the policy of rendering the greatest good to the greatest number?

To express the problem bluntly and put the question in a nutshell, is it not better for a community with $100,000 to spend to have ten miles of well drained, well consolidated roads, with an economical surface over which traffic can move safely, swiftly and comfortably

(Continued on page 20)

Projects 790 *and* 765 Under Construction

By E. H. SPIERS, *Resident Engineer*

PROJECT 790, District No. 7, is that part of State Highway No. 26 which extends from the south end of the Yadkin River Bridge at Elkin to an intersection with Highway No. 60, known as the Boone Trail, at Brooks Cross Roads, a distance of 10.12 miles in the county of Yadkin.

The country traversed is a rolling valley indented by several small streams and valleys descending eastward and tributary to the Yadkin River. About midway the highway is flanked on the west by Brushy Mountain and on the east by Rockhouse Mountain, which rise to an elevation of about five hundred feet above surrounding lands, while occasional points along the highway afford good views of the irregular summit of the Blue Ridge Mountains to the north and west and rising high above the lower lands of the Yadkin valley.

There are no unusual features in connection with either location or construction that are considered out of the ordinary.

Many years ago, there extended from house to house, rather than direct from town to town, a winding road crossed by the present highway at various places and was called the Hamptonville Road, Jonesville Road or Mud Pike. Judging from present appearances this road long outlived its day and, in about 1914, a road was surveyed and constructed by the county, using a few short stretches of the old road. Had this latter road been constructed to conform to the ''Progressive Type,'' adopted by the State, but little work would have been necessary to prepare the roadbed for the concrete pavement now being placed. However, it was found that there was much room for improvement in alignment and grades and replacement of structures necessary to bring conditions up to present State standards and requirements. Terra cotta and corrugated pipe and I-beam girders with wooden floors are all being replaced with reinforced concrete pipe, and reinforced concrete deck girder bridges with solid paneled hand rails.

Grading is light, principally earth, and averages about five thousand cubic yards per mile. The width of the roadbed is thirty feet for cuts and fills. Pavement is of plain concrete slab 6″-8″-6″ thick by 16 feet wide, of 1:2:4 mixture, flat bottom and curved surface, except on elevated curves where the same concrete area is maintained with a flat surface.

The average curvature per mile is 124°, the maximum curve, 18°. The average curvature is 10°, 30′. Tangents aggregate 78% of the distance and curves 22%. The longest tangent is 5,530 feet, the shortest 74 feet. The average length of the 48 curves is 241 feet, and of tangents 864 feet.

Ruling grades are 5%; the maximum of 6% is used in but few instances over the longest distance of 400 feet.

Running southward with the survey the plus grades average 77 feet per mile and minus, 61 feet per mile. The average rate of all grades is 2.6%. There is but 475 feet of level grade in the entire distance. All grade intersections are connected by as long vertical curves as conditions permit. Curves are super-elevated according to State standards.

The highest point reached in the grade is 250 feet above the point of beginning. These are some of the physical characteristics of grade and alignment.

Construction is now about 50% completed. Stone for concrete is obtained from a local quarry opened and operated by the contractor at Rockhouse Mountain, about two miles east of the center of the work. Sand is obtained from the Yadkin River at Elkin. All materials are handled by trucks to and from a central proportioning plant at the center of the project. The convenience of local materials and existing highways are all favorable to economical construction.

Project 765, now under construction, is also a part of Highway No. 26 and extends northward from the north end of the Yadkin River bridge at Elkin to a point where the Dobson road intersects, a distance of 3.398 miles in the county of Surry. This project furnishes similar history and physical characteristics as Project 790. There are no bridges, except the Yadkin River bridge, which is a connecting link between the projects, though not included on construction in either.

All terra cotta and corrugated pipe have been replaced by reinforced concrete pipe.

The roadbed width is 30′ to be surfaced with plain reinforced concrete slab 6″-8″-6″ thick by 18′ wide.

Except at doweled working joints, expansion and contraction will take care of itself and the cracks formed are to be poured with bituminous material. This has been done on about two miles of the pavement on Project 790 where the average joints are about 100 feet apart.

After much investigation it was found that stone suitable for concrete was not obtainable in the vicinity of the road, which necessitated hauling in stone by train from Quarry station on the Southern Railway, about 18 miles west of Elkin.

A proportioning plant at Elkin will handle materials for the entire project to be transported to the paver by trucks.

Water, as with Project 790, will be pumped from local streams.

What are the economical advantages of these highways over the old ones and what do the people in the vicinity think of them? I asked one of the most progressive and prosperous farmers of Yadkin County who owns between four and five hundred acres through which the high-

(Continued on page 13)

Vast Network *of* Roads Now Under Construction *in all* Sections

BY MALCOLM MACDONALD

AS a source of romance the building of roads is something not to be overlooked.

The tale of the highways stirs the imagination. It breathes the spirit of high adventure, of reclaiming lost territory and of meeting the emergency of threatening flood. In many respects it touches the lives of the people as is done by no other type of enterprise.

Let your fancies picture a situation such as that which arose not long ago in a low-lying region of the State of Arkansas. For its central feature the picture has one of the periodical floods of the Mississippi. The river has risen beyond the point of safety and threatens the destruction of the protective levee. The community of Old Town is in the midst of the peril and the citizens recognize the situation as critical and desperate. Unless outside help can be secured swiftly the doom of the levee is not to be averted. Old Town itself lacks the man-power, the equipment and the materials for saving the town and the surrounding farms from the ravage of destructive flood.

Word of the emergency reaches Helena, with the statement that a few hours of delay will mean enormous damage. Helena is the one place to which the community can turn for aid.

The message awakens Helena into immediate action. Every available motor vehicle is pressed into service and with the swiftness of modern transport 600 men are conveyed to Old Town with materials and tools. With grim earnestness the reinforcements join hands with the desperate people of Old Town and the flood is prevented. The arrival of assistance has been at the moment when further delay would have been fatal; and even as it is the damming of the rising waters has called for effort impossible excepting under the stress of desperation.

The Road Saved the Day

Without the new road between Helena and Old Town the tale would not have been told. In its place would have been the stark tragedy of devastation and destruction.

The road had just been constructed. Until this thoroughfare was opened the channel of communication between Helena and Old Town was hard-going at best. The rains which had produced the perilous flood had made it practically impassable, and for an emergency expedition it was hopeless. The people of Old Town do not hesitate to declare that if they had been dependent on the old road the help so urgently needed could not have reached them in time to be of service.

In the matter of roads the American people are in the position of a giant working up his muscle and getting ready to put it to use. The experience of 150 years of independence has convinced the nation that unbuilt roads are as useless as undeveloped muscles. Recognition of this truth has set us to building roads on a scale never before considered possible.

The activity in this line covers the entire country. Every State is doing its share—and most of the counties in each State. Under the wise guidance and direction of the Federal Government nothing is being left to chance. The new roads are a part of a general scheme for a national highway system, connected, closely related, and of established standard as to width and quality of construction. Completion of the undertaking will cover a good many years, but even now enough has been accomplished to show conclusively the value of the gigantic enterprise.

Planned by Engineers

Under the stimulus of the new spirit of road building the time has passed when a highway was a mere strip of clay or sand, following the line of least resistance and wandering over the landscape in haphazard fashion. The road of today is the work of the engineer.

Perfect example of the spirit is found in the road construction between Superior and Miami, in Arizona. These places are among the largest and important towns in the rich copper country of the southwest. Close neighbors in the matter of geographical location they were widely separated when it came to a question of communicating traffic. By the old road the distance between them was not less than a hundred miles. Over the thoroughfare recently constructed the distance is twenty—a saving of eighty miles, as a result of modern road-building.

To connect Superior and Miami by direct channel was no simple undertaking. Construction of the new road called for tunnels through the solid rock and the execution of other engineering feats of considerable size. That these obstacles have been overcome and that the new road affords valuable public service to an important region is as good evidence as may be asked of the worth of the movement for better roads now under full headway throughout the country.

Safety is Sought

In the new type of road construction the safety of traffic is as important as its convenience. The menace of the grade crossing is averted, wherever possible, dangerous curves are eliminated and in every phase of the work due regard is had for the prevention of highway dangers.

Evidence of the care exercised in this phase of the work is offered in the case of the road between Ariton and Clayton, in the State of Alabama. These towns are twenty-five miles apart. The old road by which they have been connected crosses the railroad tracks fourteen times in this short distance. Under the new code every grade crossing is a possible source of danger, and for this reason thirteen of the crossings have been eliminated in the plans for the new project, and the one which is retained is not considered dangerous. It took excellent engineering to accomplish this process of elimination, but the factor of safety fully justified the effort.

As a result of the new method in road-building, Maryland has rid itself of its notorious stretch of road known as "Dead Man's Curve," on the much traveled road between Baltimore and Washington. This section had been a constant menace to the heavy traffic between the two cities, because of its heavy grade, high banks which obscured the view from both directions, and the double turn known as a reverse curve. Hundreds of automobiles had been wrecked at this place and the record showed a total of 35 deaths resulting from its dangerous environment. By the expenditure of $17,000 in a single stretch less than a quarter of a mile in length, the peril of the curve has been done away with and those familiar with the situation agree that the new arrangement would have been cheap at a much higher price.

10,000 Miles a Year

These striking examples may be said to be fairly typical of the general program of improving the highways. Based on the latest available figures the construction is now proceeding at a rate of something like 10,000 miles annually. At this rate it will not be long before the nation will have a chain of communicating highways as great as its present highly developed railway mileage.

The improved highway and the railroad work together. Their functions must be regarded as coöperative rather than competitive. Even when the public roads reach the point of development equal to that of American railway both systems of communication will have full hands in caring for the constant growth of traffic.

The steam railway is primarily an agency of the long haul. When it comes to transporting freights over a considerable distance the highway offers relatively slight competition. On the other hand the motor truck has demonstrated its practical value in the handling of the short haul merchandise. In this way the one artery is supplemental to the other. For the railway the short haul is expensive and cumbersome. As much handling of merchandise is required for the haul of twenty miles as for through transportation of the same goods from coast to coast. By the same logic it is pointed out that the short haul freight uses as much space in terminal yards as is required for the more profitable business brought from a remote point. With these factors in mind it is not difficult to see that the supplemental value of the highways is considerable.

Redeeming Lost Counties

No slight part of the good road development now under way is the opening up of territory formerly separated by natural barriers from regions with which its affiliations should be closest. A notable example of this type of evolution has recently taken place in North Carolina, where the building of a much needed bridge resulted in the restoration of lost counties. Before the bridge was built and connecting highways constructed, these counties had been almost entirely cut off from the section of the State to which they rightfully belonged, and the new union was made the occasion for a celebration of State-wide magnitude. North Dakota affords another case of similar nature. The completion of a bridge over the Missouri, from Mandan to Bismarck, has given the State its only highway bridge crossing this great river north of Yankton. The Mandan bridge is one of the most conspicuous pieces of bridge construction recently undertaken in the United States, and is an important contribution to bridge engineering as well as to the unifying of State interests in the territory to which it affords communication.

Illinois takes definite pride in the work accomplished on the Lincoln Highway and other roads crossing the State. As a result of coöperation under the Federal Aid system, Illinois now has a series of trunk lines comprising a network of excellent highways covering the entire State—and all accomplished within the brief space of six years.

Much tree-planting is being practiced on the new thoroughfares, and no stretch of the imagination is required to foresee the magnificent vista of shaded arteries of traffic which will develop within the next few years under the general leadership of the United States Bureau of Public Roads. The planting of trees as memorials to the soldiers of the European War is making important contribution to the shade tree beauty of the countryside and deserves attention in every community in the United States.

What Goes Into *a* Mile *of* Concrete Road

IT IS a simple matter for any contractor to figure out the amounts of cement, sand and gravel needed for a certain length of highway construction. In fact Bulletin 1077 of the United States Department of Agriculture contains a vast amount of this sort of information, with tables giving approximate figures for various thicknesses of pavement. Information on the preliminary work is not so easily obtainable, however, and there are some amazing sidelights to the construction industry that the contractor has but little opportunity to come in touch with.

For example, the government bulletin estimates that a mile of concrete pavement, 7 in. thick at the edges and 8 in thick at the center, will require 3,913 bbls. of portland cement, including 1,102 cu. yd. of sand, or fine aggregate and 1,664 cu. yd. of coarse aggregate or stone.

In making 3,913 bbls. of portland cement, over 390 tons of coal are burned at the cement mill. Approximately 19 tons of gypsum are required to regulate the setting time of the material. To get the cement shipped to the construction job, over 15,600 cloth cement sacks are needed—and approximately 15 bales of cotton must be woven into cloth to supply this item. Incidentally, over 30,000,000 cloth cement sacks are lost or destroyed each year, and the textile milles are called on to furnish material for the replacements. Back in the cement quarries, approximately 450 lbs. of dynamite were shot off in blasting loose the raw materials required for the cement for the mile of highway.

The government bulletin estimates that 30 gals. of water are needed to mix and cure a square yard of concrete pavement. Over 300,000 gals. of water must be furnished for the mile of road, and approximately 4,500 tons of concrete go into the construction.

A good idea of what the highway construction business means to the railroads can be obtained from the requirements of the mile of concrete road. About 42 cars of fine aggregate, or sand, are needed on this job. Sixty-five cars of coarse aggregate are required and it takes 20 cars to haul the cement—or 127 cars for the basic materials. Where reinforcing is specified, further transportation is called for, while the water supply is governed by local conditions. In addition to these requirements, the drainage, grading, bridge and culvert construction must all be provided for.

When it is considered that the equivalent of over 7,000 miles of 18-foot concrete pavements were placed under contract during this year, the enormity of the transportation end of the work is easily seen. More than 880,000 freight cars are needed to transport the cement, sand and gravel for this operation. As the peak of the demand comes during the late summer and fall, there is added difficulty in getting materials on the job at exactly the time desired. Early shipments of construction materials, and loading of all cars to capacity limit would go a long ways toward alleviating the congested conditions.

—*Engineering and Contracting.*

Project 790 *and* 765 Under Construction

(Continued from page 10)

way passes this question. He stated that he gave $30 per acre for his land about ten years ago and he now considers it worth about a hundred. I asked another citizen the same question, who owns a farm just touching the highway. He said about twelve years ago he gave $9 per acre for his farm and recently had refused $100. This gives a fair idea of recent and present values.

Glancing at the recently issued highway maps of the State showing the various types of State roads and following Highway No. 26 from the State line via Sparta, Elkin, Statesville and Charlotte to the State line on the south, it is fair to assume that the remaining unpaved links will not long be permitted to remain so, and ere long Highway No. 26 will be one of the most popular State and interstate roads of North Carolina.

We are working with the intention that these projects will be so well constructed that they will prove a credit to all concerned and not be exceeded in service-life by any in the State.

Should you approach Project 790 from the south en route to Elkin, the first mile traveled will be a descending tangent over which your car will travel so easily that the State limit of 30 miles per hour will seem slow. An average of 25 miles per hour will land you at Elkin in just 24 minutes.

The contractors and engineers have met with no opposition on the part of the citizens, who have been bearing with patience the inconveniences to which they have been subjected; but rather a spirit of coöperation and good will has ever been appreciated.

It will not be long before free camping grounds, and probably shower baths, would prove a blessing to the long distance traveler, and the city or community that furnishes these comparatively inexpensive conveniences will be running a favorable advertisement for itself, the highway and the State.

FRANK PAGE

Gentleman—Banker—Soldier—Road Builder

(Continued from page 5)

handle the whole technical end of the job. He, therefore, devoted practically all of his time to the development of the administrative and executive organizations.

Teamed together, these two men have made records that are not yet appreciated outside of North Carolina and few adjacent States. They had 5,000 miles of existing highway under regular, thorough, systematic maintenance within the first six months. By this move every part of the State quickly saw that the Commission could do things quickly, effectively and economically.

Meanwhile, new work was being started on a scale that scarcely seemed practicable, considering the previous lack of organization, of developed sources of materials and of experienced contractors. In 17 months nearly 2,000 miles of road was placed under contract. In 1922 over 800 miles of road was completed. The estimate is that 1,200 miles of new work will be built in North Carolina this year. Practically all of this mileage has required new locations, new structures and much heavy grading. Conditions varying all of the way from tropical swamps to some of the roughest mountains east of the Rocky Mountains had to be met.

Probably no better measure of what North Carolina thinks of the work of its State Highway Commission could be had than the action of the last legislature in approving an additional $15,000,000 appropriation for road work. More would have been furnished, but Frank Page said that was all that could be spent before the legislature would meet again.

How Frank Page gets things done has been variously estimated by different people who have seen different sides of him. He is primarily courageous and fearless. He is more than reasonable when dealing with a reasonable man but never runs away from a fight. He has no more respect for the political bosses of the State than he has for an ordinary citizen. He has acquired in some quarters a reputation for being somewhat of an autocrat. The general manager of one of the leading railroads that cross North Carolina when asked recently what he thought of Frank Page said: "Frank Page may have a reputation of being something of a czar, but he certainly does get things done."

Frank Page has one failing, if it is a failing, for a man in a public position of such importance as the one that he fills—he avoids publicity. He never has much to say about what he has done or what he intends to do. He will probably not say much about his program as president of the American Road Builders' Association. A year hence, however, his leadership will have left a permanent record of progress in making that organization what it should be as really representative of the highway builders of the country.

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STATUS OF STATE WORK IN NORTH CAROLINA

Projects Under Construction

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	BEGUN	CONTRACTOR
101	Beaufort	4.23	P. C.	$ 145,492.76	1-20-23	Public Service Production Co.
105A	Beaufort	2.00	P. C.	78,839.42	11-11-22	J. L. McGhee Cont. Co.
105B	Beaufort	5.037	P. C.	164,301.61	1-19-23	Public Service Production Co.
106	Bertie	7.12	T. S.	58,204.90	9-11-22	J. F. Mulligan Const. Co.–Boney & Hostetler.
107	Bertie	19.30	Graded	50,127.00	3-14-23	Nello Teer—Atlantic Bridge Co.
110	Camden	2.71	R. C.	134,866.48	7-11-22	State Forces
113	Chowan	10.32	Graded	39,743.33	2—1-22	Nello L. Teer—Gregory & Talbot.
113B	Chowan	9.89	S. A.	100,000.00	4-9-23	State Forces.
115	Chowan-Perquimans	11.83	P. C.	326,304.00	5-15-23	Smith Brothers, Inc.
129	Edgecombe	8.1	Graded	40,850.00	9-14-22	State Forces
131	Gates	15.95	T. S.	135,515.60	8-22-22	Bacon & Moore—W. D. Murray—Sadler Corp.
132	Gates	10.90	T. S.	63,921.00	8-29-22	J. A. Marrow.
133	Gates-Pasquotank	14.07	Gravel	138,045.77	11—7-22	C. W. Lacy—Pittsburg Des Moines Steel Co.
137	Halifax	5.95	Bit Mac & P. C.	180,441.92	11-21-21	O. F. Leighton—A. C. House.
138A	Halifax-Northampton	12.59	S. C.	131,712.13	5—1-22	Nello Teer—Richards Bros.
138B	Northampton-Halifax		Bridge	347,188.74	2-28-23	Pensacola Shipbuilding Co
145	Hertford	12.88	Graded	88,161.42	7-31-22	Jameson & Bro.—Atlantic Bridge Co.
147	Hertford-Bertie	17.36	Graded	122,245.86	3—5-23	Nello Teer—Atlantic Bridge Co.
151	Hyde	4.30	T. S.	71,422.28	12-10-21	C. W. Lacy—Porter & Peck.
152	Hyde	10.89	S. C	75,651.40	1-15-23	O. A. Mann & Co.
154	Martin	11.27	A. C.	394,153.29	4-17-22	Sou. Willite Paving Co.—O. F. Leighton, Inc.
155	Martin-Pitt	20.01	T. S.	98,176.65	1—9-22	J. P. Dicus—J. M. Gregory.
155B	Martin	19.3	P. C.	493,900.40		W. T. Hadlow.
157A	Martin	12.50	T. S.	85,813.86	10-18-22	Jamison & Bro.—J. A. Marrow.
157B	Martin	12.50	T. S.	90,396.24	11-13-22	J. F. Mulligan Constr. Co.—Batson Cook Co.
159	Nash	11.22	T. S.	89,942.43	1—2-22	J. A. Kreis & Co.
167	Northampton	20.48	T. S.	92,444.11	7-17-22	Virginia Contr. Co.—Bacon & Moore.
173	Perquimans-Pasquotank	7.22	R. C.	239,444.70	8-25-22	Williams & Williams.
174	Pasquotank-Camden	2.40	Cord	55,818.01	4—3-22	D. E. Williams.
183A	Pitt	13.54	P. C.	399,854.40	11-13-22	S. J. Groves & Sons.
183B	Pitt		Bridge	32,343.30	3-27-22	B. J. Boyles.
184	Pitt	7.14	P. C.	206,516.42	11-21-22	Public Service Production Co.
185	Pitt	14.35	Graded	31,069.72	3-29-22	J. A. Marrow.
191	Tyrrell	6.91	S. C.	58,594.41	1-20-22	C. W. Lacy—M. M. Jones.
195	Washington	15.18	S. C.	65,619.35	2-28-22	L. M. Lee & Co.—B. J. Boyles.
196	Washington	14.93	S. C.	83,632.78	5-15-22	W. N. Thompson.
200	Carteret	13.68	Graded	79,629.00	7-21-22	Eagle Eng. Co.—Batson-Cooke Co.
201	Carteret	14.14	Graded	81,652.62	1-17-23	Duplin Constr. Co.—Batson Cooke Co.
210	Craven	8.34	A. C.	292,698.06	4—3-22	West Construction Co.—A. P. Gilbert.
219	Duplin-Lenoir	15.60	Graded	148,339.29	6-1—21	Chitwood & Carpenter.
220	Wayne-Duplin	14.53	A. C.	394,301.05	2-27-23	Union Paving Co.
236 {F A 143	Johnson	14.83	A. C.	475,321.55	10-2-22	R. G. Lassiter & Co.
245	Jones	15.67	P. C.	265,179.53	3-22-22	Hyde & Baxter.
254	Lenoir		Bridge	73,415.32	11-22-22	Roanoke Iron & Bridge Co.
256	Lenoir		Bridges	57,680.00	1-11-23	Englehardt-Kuehen.
263	Pamlico	12.03	A. C.	289,324.20	3-27-22	Union Paving Co.
264	Craven-Pamlico		Bridge	27,156.25	7-24-22	Rhyne & Kitchen.
272	Sampson	16.47	Graded	98,807.39	6-19-22	R. E. Martin—Striblin—Stauddy & Newell.
273	Sampson	2.44	P. C.	96,916.82	2-27-23	Eagle Engineering Co.
275	Sampson		Bridges	8,769.74	4—4-23	Rhyne & Kitchen.
282	Wayne	14.22	A. C.	398,168.00	11-11-22	Union Paving Co.
291	Wilson	7.63	A. C.	203,498.18	1-17-22	P. R. Ashby.
291B	Wilson		Bridges	12,990.23	4—4-23	Jno. M. Ogden & Co., Road not let.
294	Wilson		Bridge	15,770.80	11-29-22	Stearns Bros.
300	Bladen	11.99	S. C.	64,911.71	4—8-22	T. W. Chandler—Nello Teer.
301	Bladen	13.17	T. S.	82,028.21	11-21-21	J. F. Mulligan—Powell Paving & Const. Co.
312	Brunswick	9.77	P. C.	347,319.68	7—5-22	Alabama Conc. Prod. Co.—Batson-Cooke Co.
313	Brunswick	3.44	A. C.	105,706.65	3-15-22	Sou. Willite Paving Co.—Roanoke Bridge & Iron Works.
314	Brunswick	15.82	S. C.	109,259.10	2-23-22	Hagedorn Const. Co.
316	Brunswick	12.12	S. C.	80,068.72	8-14-22	B. Frank Price—Batson, Cooke Co.
317	Brunswick		Bridge	19,783.20	11-30-22	Atlantic Bridge Co.
325	Columbus	11.22	T. S.	105,530.04	11—3-21	J. A. Kreis-Cornell-Young Co.
326	Columbus	13.61	S. C.	195,838.19	5-23-22	J. T. Plott—J. A. Kreis & Co.
327	Columbus	5.2	S. C.	38,269.44	6-21-22	J. A. Kreis.
328	Columbus	7.03	P. C.	219,371.68	12-26-22	L. L. Tindall
340	Cumberland	11.07	P. C.	381,032.02	6-15-22	Alabama Conc. Prod. Co.—Hobbs & Peabody.
342	Cumberland	5.91	A. C.	177,402.50	10-30-22	A. J. Wardrep.
351	New Hanover	10.64	A. C.	189,540.00	1—8-23	Southern Willite Paving Co.
363	Onslow	15.24	T. S.	208,476.95	3—5-23	Newell Constr. Co.—Pittsburg-Des Moines Steel Co.
364A	Onslow	9.95	S. C.	44,631.40	3-14-22	R. E. Martin.
364B	Onslow	12.84	T. S.	99,819.50	6-26-22	A. W. McClay.
376	Pender	7.64	Graded	94,757.85	11-11-21	C. G. Kershaw Const. Co.—Cornell Young Co.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Under Construction (Continued)

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	BEGUN	CONTRACTOR
377	Pender-Duplin....	1.61	S. C.	$ 76,985.70	3-22-22	R. E. Martin-Hazell-Conerat-Quist Co.
378	Pender...........	14.12	W. B. Mac.	213,502.96	7-19-22	C. W. Lacy.
379	Pender...........	10.00	S. A.	100,000.00	5-22-22	State Forces.
380	Pender...........	8.98	W. B. Mac.	162,212.60	3—6-23	C. W. Lacy.
386-87	(F A-140) Robeson	19.8	P. C.	647,888.05	9-4-22	James O. Heyworth.
389	Robeson-Colum....	1.56	T. S.	83,463.38	10-26-21	L. A. Chitwood.
391A	Robeson.........	1.01	S. A.	43,332.08		R. G. Lassiter
391B	Robeson.........	1.10	T. S.	17,433.00	2-26-23	H. M. Beasley.
392	Robeson.........	1.06	T. S.	24,937.00	5—1-23	Robeson Co., Com.—E. T. Gwathney.
400	Chatham.........	....	Bridge	57,420.22	4-14-22	R. M. Walker & Co.
402	Chatham.........	6.92	T. S.	33,940.28	8—1-22	W. N. Thompson.
403	Chatham.........	7.01	T. S.	66,814.00	2-27-23	C. G. Kershaw.
411	Durham..........	5.81	P. C.	211,574.92	9-15-21	Hutton Eng. & Const. Co.
412	Durham..........	8.80	P. C.	252,582.00	11-15-22	L. L. Tindall.
419	Franklin..........	12.82	T. S.	63,021.97	7-27-22	Jamison Bros.—J. M. Gregory.
428	Granville.........	4.19	R. C.	142,637.77	7-14-22	Pittman Const. Co.
429	Granville.........	6.94	P. C.	261,393.00	3-21-23	R. B. Sandidge.
437	Harnett..........	10.74	Gravel	101,031.26	5—8-23	F. P. Holder—T. J. Newell.
456	Orange...........	9.81	Graded	37,459.07	1—7-22	Crawford & Crawford—Nello Teer.
457A	Orange...........	7.45	Graded	75,398.67	4-12-23	Dicus Bros.—Richards Bros.
460	Orange...........	9.87	A. C.	296,835.55	9-25-22	R. M. Hudson & Co.
463 {F A	Person...........	11.24	P. C.	327,171.35	8-14-22	Porter & Boyd.
473 {146	Vance............	7.83	P. C.	265,546.60	7-11-22	R. G. Lassiter & Co.
481	Wake............	7.40	A. C.	254,995.34	1-24-22	Union Paving Co.—P. R. Ashby.
484	Wake............	8.79	P. C.	311,590.40	8-23-22	P. R. Ashby-Booz-Lloyd & Co.
485A	Wake............	7.35	Graded	92,818.00	5—4-23	C. G. Kershaw Construction Co.—T. J. Newell.
486	Wake............	9.04	T. S.	41,074.00	4-11-23	O. A. Mann & Co.
492	Warren..........	4.48	Bit Mac	100,436.13	4-10-22	Porter & Peck—A. C. House.
493 {F A	Warren..........	3.39	Bit Mac	77,866.80	7-27-22	Porter & Peck.
494 {147	Warren..........	6.21	A. C.	208,130.01	9—6-22	Clifford Engineering Co.
502	Alamance........	17.43	T.S. & B.M.	138,629.97	7-17-22	W. E. Graham—Hanford Bros.
503	Alamance........	....	Bridge	59,450.38	7-17-22	Atlantic Bridge Co.
512	Caswell..........	11.67	T. S.	54,375.53	2-19-23	J. T. Plott.
525	Davidson.........	10.24	A. C.	363,850.08	12-23-21	Elliott & Sons & Boggs—Austin Bros. Bridge Co.
528	Davidson.........	10.24	P. C.	427,511.92	10-2-22	Hagedorn Constr. Co.—J. A. Peterson.
532	Guilford..........	11.70	A. C.	385,957.88	2—1-22	Elliott-Sholes Co.
532B	Guilford..........	....	Bridges	24,730.00	1—5-23	L. M. Lowdermilk.
533	Guilford-Forsyth..	10.59	P. C.	427,997.62	7-11-21	Royer-Ferguson Const. Co.
535	Guilford..........	7.78	R. C.	277,955.21	4-19-22	Leaksville Lumber Co.
544	Hoke............	10.45	S. C.	32,445.49	5-16-22	O. A. Mann & Co.—Chitwood & Carpenter.
545	Hoke............	9.15	T. S.	58,195.06	6—5-22	O. A. Mann & Co.—A. W. McClay.
555	Montgomery......	20.55	T. S.	103,708.00	2-19-23	Mayfield Construction Co.—F. P. Holder.
566	Moore...........	7.14	T. S.	62,079.21	3—6-22	Gibson Const. Co.—Nello Teer.
569	Moore...........	18.97	S. C.	97,151.45	8—1-22	Mayfield Const. Co.
570	Moore...........	22.70	T. S.	90,804.33	5-22-23	A. B. McDonald.
577 {F A	Randolph........	13.77	P. C.	422,343.57	4-18-22	Royer-Ferguson Co., Inc.—J. L. Brinkley.
578 {156	Randolph........	7.91	P. C.	308,537.68	5-10-23	Allport Construction Corporation.
588	Rockingham......	7.98	R. C.	266,498.43	4-11-22	Cheatwood & Driscoll.
589	Rockingham......	9.81	P. C.	324,975.31	10-30-22	Cheatwood & Driscoll—Atlantic Bridge Co.
590	Rockingham......	2.10	P. C.	66,092.18	12-5-21	Geo. R. Martin
593 {F A 38	Rockingham-Caswell...........	17.98	P. C.	525,393.22	7-11-22	J. A. Kreis.
600	Alexander........	9.3	Graded	12,530.98	5-26-22	Bolton Construction Co.
602	Alexander........	9.28	Bit Mac	189,329.80	10—9-22	W. E. Graham.
606	Stanley-Anson....	....	Bridge	54,759.32	3-23-22	Concrete Steel Bridge Co.
607	Anson............	6.39	T. S.	37,098.91	3-21-22	Geer & Wilson—Booz-Lloyd & Co.
608	Anson............	7.88	A. C.	345,408.58	9-27-22	Lampton & Burks—J. A. Peterson.
614 {F A	Cabarrus.........	9.20	P. C.	350,085.07	7-21-22	A. L. Harris—Oliver & Costello Bros.
615 {144	Cabarrus.........	3.88	A. C.	98,741.17	3—9-23	Thompson-Caldwell—Atlantic Bridge Co.
616	Cabarrus.........	8.59	Gravel	46,024.00	4-12-23	Lee J. Smith—L. M. Lefler.
622	Catawba.........	10.85	A. C.	354,321.44	1-23-22	Union Paving Co.
629	Catawba.........	7.52	P. C.	268,662.48	6—5-22	A. L. Harris—R. M. Thurmond & Co.
630B	Gaston..........	6.65	A. C.	218,625.00	8—8-22	W. F. McCanless, Hobbs-Peabody Constr. Co.
632	Gaston..........	8.50	R. C.	291,868.94	1—2-22	Davis-Wilcox Const. Co.
633B	Gaston..........	3.8	A. C.	57,247.41	1—6-23	Gaston County.
639	Iredell...........	10.59	A. C.	387,346.19	1—2-22	R. M. Hudson Co.—Luten Bridge Co.
640	Iredell...........	8.17	Bit Mac	181,990.82	9-26-22	W. E. Graham.
643 {F A 157	Iredell...........	8.57	A. C.	321,614.81	5-21-23	Stearns Brothers.
647	Lincoln..........	7.10	P. C.	250,108.15	6—5-22	A. L. Harris—R. M. Thurmond & Co.
653	Mecklenburg......	8.84	A. C.	308,732.43	2-28-22	Union Paving Co.—Luten Bridge Co.
654	Mecklenburg......	10.1	A. C.	302,887.09	4—3-22	Lampton & Burks.
658 {F A 145	Mecklenburg......	9.55	A. C.	266,758.80	10—9-22	Union Paving Co.
659	Mecklenburg......	7.93	Graded	36,650.00	4—9-23	County Commissioners—Luten Bridge Co.
661	Richmond........	9.76	T. S.	40,683.41	7-18-22	McDonald & Brooks.
665	Richmond........	5.77	A. C.	194,501.23	7-28-22	A. J. Wardrep.
670	Cabarrus-Rowan..	4.53	P. C.	142,221.53	6-29-22	Harris Construction Company.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Under Construction (Continued)

NO.	COUNTY	LENGTH	TYPE	ESTIMATED COST	BEGUN	CONTRACTOR
671	Rowan...........	7.34	A. C.	309,262.14	3-20-23	Thompson-Caldwell Construction Co.,—Atlantic Bridge Co.
673	Davidson-Rowan..	.59	Bridge	221,353.00	9-19-22	Hardaway Contracting Co.—Elliott & Sons.
677	Scotland-Robeson.	7.11	R. & P. C.	$ 283,460.61	4-26-22	P.R. Ashby—J. B. Murphy.
691	Union...........	....	Bridge	14,520.00	2-13-23	J. S. Brinkley.
694	Union...........	....	Bridge	23,549.13	11-14-22	Hagedorn Construction Co.
696	Union...........	6.05	A. C.	139,901.30	1-30-23	Redmon Construction Co.
700	Alleghany........	7.90	W. B. Mac	132,297.33	6-23-21	W. E. Graham.
701	Alleghany-Wilkes..	8.00	W. B. Mac	166,245.20	6-16-21	W. E. Graham.
702A	Alleghany........	7.75	Bit Mac & Gravel	209,188.98	10-31-22	O'Brien Constr. Co.—Luten Bridge Co.
711	Ashe.............	6.50	Gravel	60,000.00	9—7-22	Little Contracting Co.
712	Ashe.............	11.06	Gravel	197,687.38	10-24-22	J. T. Plott.
713 {F A 139	Ashe.............	3.53	P. C.	166,595.00	8-22-22	Overstreet & Nance—Concrete Steel Bridge Co.
724	Caldwell..........	4.66	T. S.	51,890.66	5—8-22	County Road Commrs—R. M. Thurmond & Co.
726 726A	Caldwell.........	11.00	Gravel	50,000.00	5—5-23	State Forces. J. F. Mulligan Construction Co.
731	Davie............	5.46	P. C.	195,393.11	3-13-22	G. R. Martin-Heilig & Sherrill.
741	Forsyth..........	8.90	P & R. C.	315,025.81	7-27-22	Hardaway Construction Company.
742 {F A 137	Forsyth..........	10.62	R. C.	413,067.27	6-20-22	Harris Construction Co.
743	Forsyth..........	11.35	A. C.	414,085.43	4—2-23	Atlantic Bitulithic Co.
744	Forsyth..........	2.00	T. S.	*................	1-11-22	Forsyth County.
750	Stokes...........	14.86	T. S.	93,054.48	9-15-21	J. F. Mulligan Const. Co.—Lee J. Smith.
752	Stokes...........	9.67	T. S.	124,874.75	2-17-23	W. E. Graham.
761	Surry............	2.22	P. C.	77,334.01	11-22-22	Geo. R. Martin.
765	Surry............	3.40	P. C.	112,685.76	10-24-22	Campbell Constr. Co.
770A	Watauga.........	3.00	Bit-Mac.	40,000.00	8-12-22	State Forces.
770B	Watauga.........	8.90	Gravel	93,500.00	4-16-23	State Forces.
771A	Watauga.........	2.50	Bit. Mac	30,000.00	9—7-22	State Forces.
771B	Watauga.........	13.50	Gravel	35.000.00	9—7-22	State Forces.
780	Wilkes...........	7.83	Recon	25,000.00	7-25-21	J. F. Mulligan.—State Forces.
781	Wilkes...........	14.50	Recon	154,000.00	7-25-21	J. F. Mulligan.—State Forces.
782	Wilkes...........	5.97	R. C.	184,614.65	3-29-22	Hyde & Baxter.
783	Wilkes-Watauga ..	36.00	Gravel	174,900.00	9—2-21	Chandler & Ragland
784	Wilkes...........	4.97	T. S.	85,966.21	8-30-22	J. F. Mulligan Constr. Co.—Foster Constr. Co
785	Wilkes...........	2.52	P. C.	78,703.50	4—2-23	J. D. Brookshire & Co
790	Yadkin...........	10.12	P. C.	330,254.27	4-24-22	Pittman Construction Co.
800	Avery............	5.84	Grav & R C	198,827.02	7-31-22	O'Brien Const. Co.—J. A. Kreis.
811	Burke............	5.24	P. C.	185,132.97	1-13-22	Southern Dray Co.
815	Burke-Clev'nd.-Lincoln	11.63	T. S.	153,126.60	4-28-22	Geer & Wilson—J. L. Van Glahn.
821	Cleveland........	1.58	P. C.	60,192.33	10-31-22	Davis-Wilcox Constr. Co.
822 {F A 150	Cleveland........	10.47	A. C.	404,444.48	9-27-22	Elliott & Sons—J. A. Kreis & Co.
833	Henderson........	5.20	Gravel	34,952.94	1—3-22	S. L. Davis Const. Co.—Asheville Const. Co.
846	McDowell........	10.06	Gravel	204,680.74	9-22-21	Asheville Const. Co.—W. T. Taylor Const. Co.
847	McDowell........	3.84	Graded	91,217.50	10-19-22	C. W. Lacy—Oliver & Costello Bros.
848	McDowell........	....	Bridge	18,597.04	11-21-22	R. M. Thurmond & Co.
856	Mitchell..........	6.88	Bit Mac	239,343.83	3-20-22	Porter & Boyd—L. J. Chandler & Co.
858	Mitchell..........	....	Bridge	42,367.49	10-2-22	R. M. Thurmond & Co.
860	Mitchell..........	5.65	W. B. Mac	152,908.42	4-21-22	J. F. Mulligan—W. H. Anderson Const. Co.
876 {F A 78B	Rutherford.......	4.80	P. C.	146,264.80	10-30-22	Fiske-Carter Construction Co.
882	Rutherford.......	15.80	T. S.	105,210.61	9-20-22	C. R. Willard & Sons—Michaux Const. Co.
888	Yancey...........	15.22	W. B. Mac	230,499.94	10-10-22	The Luck Co.
901 {F A 148	Buncombe........	7.52	P. C.	354,082.45	11—6-22	R. C. Stephens—A. J. Wardrep
903	Buncombe........	2.58	A. C.	100,399.47	4-10-22	Asheville Paving Co.—R. C. Stevens.
904	Buncombe........	1.60	A. C.	80,969.13	3-13-22	Asheville Paving Co.—R. C. Stevens.
911	Cherokee.........	10.33	Gravel	144,991.44	10-25-21	H. A. Wells—Southern Dray Co.
913	Cherokee.........	10.33	W. B. Mac	95,554.80	8—8-22	Mills, Williams Construction Company.
920	Clay.............	5.01	Gravel	50,716.66	1—9-22	E. A. Wilson & Co.—W. T. Moore Conc. Prod. Co.
921	Clay.............	12.37	Gravel	99,988.02	10-24-21	Lee J. Smith Const. Co.—W. T. Moore Conc. Prod. Co.
930	Graham..........	12.90	Gravel	143,574.20	10-15-21	Lee J. Smith Const. Co.—C. M. Dicus.
940	Haywood.........	7.13	W. B. Mac	126,069.30	4-14-22	Alexander & Patton—H. A. Brown & Co.
944 {F A 16	Haywood.........	10.18	A. C.	409,683.45	5-14-23	A. J. Wardrep.
950	Jackson..........	7.56	Gravel	145,313.30	6-13-21	Wright & Nave—O'Brien Const. Co.
951	Jackson..........	11.85	W. B. Mac	249,546.00	8-17-22	R. H. Wright & Sons—W. T. Moore Conc. Prod. Co.
952A	Jackson..........	10.35	Graded	164,126.60	8-17-22	Brooks-Calloway Company.
953	Jackson..........	12.72	Graded	118,186.75	7—1-22	C. C. McCabe.
954	Jackson..........	1.68	P. C.	90,871.77	7—1-22	Mills, Williams Construction Company.
960	Macon...........	4.97	S. C.	69,100.57	6—6-21	J. T. Plott—J. E. Lane & Co.
961	Macon...........	4.77	T. S.	58,340.59	12—5-21	J. T. Plott—J. E. Lane & Co.
962	Macon...........	13.58	W. B. Mac	171,200.05	4-24-22	O'Brien Const. Co.—Griffin Const. Co.
963	Macon...........	8.68	Graded	124,354.01	11-10-22	Costello Bros.—Brooks-Calloway Co.
970	Madison-Yancey..	13.80	W. B. Mac	218,940.17	11-11-21	R. H. Wright & Sons—O'Brien Const. Co.
971	Madison.........	6.74	Gravel	114,026.00	4-23-23	Reynolds Const. Co.-MooreConcreteProd. Co.
972	Madison.........	7.00	Graded	9,000.00	4—6-23	State Forces.
980	Macon-Swain.....	17.84	W. B. Mac	350,175.11	3-20-22	Costello Bros.—Condon & Condon.
990	Transylvania.....	8.87	W. B. Mac	151,238.89	6—5-22	Sam L. Davis Const. Co.—R. C. Stevens.
991	Transylvania.....	7.03	Graded	156,653.20	3—6-23	Gibson Construction Co.

*Built by county.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Completed

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	COMPLETED	CONTRACTOR
100	Beaufort	10.50	R. C.	$ 369,777.70		W. T. Hadlow
103	Beaufort	.03	R. C.	1,706.75	7—3-22	R. G. Lassiter.
114	Chowan	10.40	Graded	45,064.09	4-14-23	Battershill & Goode—Chandler & Ragland.
125	Edgecombe	15.11	A. C.	426,438.76	4-23-23	R. G. Lassiter.
139	Halifax		Bridge	*20,425.59	8-25-22	Chandler & Ragland—Porter & Peck.
140	Halifax		Bridge	*11,043.05	5—5-22	Von Glahn & Talbott.
160	Frklin.-Wake-Nash	8.93	T. S.	53,722.95	3—7-23	Chandler & Ragland—Southern Dray Co.
166	Northampton	.47	Bridge	17,954.75	9-14-22	W. D. Murrey—Sadler Corp.
175	Pasquotank	9.50	Brick	217,405.72	4-19-23	County Commissioners.
186	Pitt	9.57	R. C.	*248,103.78	8—5-22	Cheatwood & Driscoll.
209	Craven	2.65	P. & R. C.	*114,569.02	2-15-22	Eagle Engineering Co.
211	Craven	9.93	A. C.	288,946.02	5-16-23	Union Paving Co.
218	Wayne-Duplin	16.06	Graded	92,589.58	2-24-23	C. W. Lacy.
227	Greene	6.81	A. C.	239,797.80	1-25-23	West Construction Co.—Union Paving Co.
255	Lenoir	0.82	S. A.	30,384.89	8-18-22	West Construction Co.
280	Wayne	10.01	A. C.	311,352.36	5-12-23	Union Paving Co.
281	Wayne		Bridge	*21,225.49	1-15-23	P. R. Ashby.
338	Cumb.-Samson		Bridge	26,323.99	9-26-22	Roanoke Bridge & Iron Works.
339	Harnett-Cumb	.754	T. S.	19.067.28	8-31-22	Porter & Boyd
341	Cumb.-Hoke	.2	Graded	*1,042.55	2-28-22	W. B. Covington
375	Pender	13.56	S. C.	68,830.09	11-21-22	A. W. McClay
388	Robeson	3.35	R. C.	137,009.40	9-28-22	C. W. Lacy—Roanoke Bridge & Iron Co.
409	Durham	0.5	Graded	*5,409.10	8—7-22	J. P. Dicus.
410	Durham	2.3	R. C.	*81,105.75	9-28-22	C. D. Riggsbee.
420	Franklin	1.56	R. C.	55,421.30	5-29-23	Chandler & Ragland.
427	Granville	5.12	A. C.	178,257.64	1—4-23	R. G. Lassiter & Co.
436	Harnett	21.91	Gravel	202,563.88	1-15-23	C. G. Kershaw Const. Co.—Hobbs & Kitchen.
445	Lee	5.91	T. S.	18,692.85	1-15-23	C. B. Hester.
446	Lee	5.90	A. C.	197,188.22	1-15-23	Atlantic Bitulithic Co.—O. A. Mann & Co.
453	Orange		Bridge	33,706.80	1—9-23	Geo. W. Kane.
454	Orange	4.28	P. C.	197,675.32	3-6-22	Elliott, Sholes & Teer.
455	Orange	4.19	T. S.	*55,214.44	9-28-22	J. F. Mulligan Const. Co.—P. R. Ashby.
482	Wake	6.64	A. C.	*184,393.31	9-23-22	R. M. Hudson Company.
483	Wake	0.54	R. C.	*15,630.74	8-7-22	C. D. Riggsbee.
500	Alamance	5.22	Graded	*36,844.34	1-17-22	W. W. Tuck & Son—A. M. Hazell, Connerate—Quist Construction Co.
501	Alamance	13.1	T. S.	30,927.27	2-28-23	W. M. Shook-Hanford Bros.
504	Alamance	5.22	A. C.	154,127.16	5—3-23	Elliot & Sholes.
505	Alamance	0.42	S. A.	*15,229.74	6-23-22	Hedrick Construction Co.
511	Caswell	14.80	T. S.	73,242.18	10-11-22	White & Simpson-C. B. Hester
524	Davidson	0.3	S. A.	*9,941.54	1-20-22	Town of Lexington.
525A	Davidson	.5	S. A.	*16,419.86	6-27-21	Town of Lexington.
526	Davidson	3.77	P. C.	*131,269.66	10-25-22	Hagedorn Constr. Co.—Heilig & Sherrill.
538	Guilford		Bridge	7,039.01	2-21-23	J. L. Brinkley.
539	Guilford	0.64	S. A.	21,639.20	1-19-23	Robt. G. Lassiter & Co.
540	Guilford	18.00	Recon.	16,527.54	1-23-22	J. T. Plott.
546	Hoke	0.84	S. A.	27,949.00	5-30-23	Dawkins Construction Co.
567	Moore	2.96	T. S.	*9,967.53	9-18-22	C. E. Teague.
601	Alexander	3.07	T. S.	33,630.45		Guss Ginn-R. M. Thurmond
630A	Gaston	3.02	A. C.	*98,854.41	7- -22	W. F. McCanless.
633A	Gaston	13.77	A. C.	180,000.00	10-5-22	Gaston County
634	Gaston	Bridge	Recon.	4,500.00		State Forces.
638	Iredell	7.88	A. C.	262,142.65	1-20-23	Thompson-Caldwell Co.
652	Mecklenburg		Bridge	1,923.28	10-30-22	State Forces.
655	Mecklenburg	1.57	P. C.	63,695.17	7-31-22	Speed-Parker Co., Inc.—Luten Bridge Co.
656	Mecklenburg	10.4	Bit.-Mac.	200,000.00	10-30-22	State Forces.
657	Mecklenburg	13.80	Recon.	20,000.00	10-30-22	State Forces.
692	Union	2.28	A. C.	*65,279.20	12-28-21	Redmon Construction Co.
693	Union	1.14	Gravel	3,324.48		Sykes-Collins Co.
695	Union	4.51	A. C.	*138,738.07	9-14-22	Redmon Construction Co.
710	Ashe	3.14	P. C.	*142,707.93	8-17-22	Pittman Construction Co.
719	Caldwell		Bridge	*7,906.87	6-26-22	Cottrell & Howard.
719B	Caldwell	.99	Gravel	1,665.33	11-15-22	J. G. Bumgardner
722	Caldwell	7.40	Recon	*20,923.25	1-18-22	County Forces.
724	Caldwell	4.66	T. S.	51,890.66	4-13-23	County Forces—R. M. Thurmond & Co.
725	Caldwell	4.00	Recon	28,015.46	2-24-23	County Commissioners.
751	Stokes	7.16	T. S.	*35,124.08	10-4-21	W. E. Graham.
760	Surry-Alleghany	6.9	T. S.	*32,084.18	11-5-22	W. E. Graham.
764	Surry	1.63	R. C.	50,588.20	2—4-23	Leaksville Lumber Co.
801	Avery	.99	W. B. Mac	22,350.24	10-26-22	Geer & Wilson.
814	Burke	8.69	S. C.	13,459.60	4-25-23	M. A. Kollock.
823	Cleveland	1.90	P. C.	*80,421.65	8-15-22	Southern Paving Co.—Z. B. Weathers & Son.
844	McDowell	1.8	P. C.	*61,233.34	12-13-21	Bolton Construction Co.
845	McDowell	7.19	Gravel	132,177.93	12-22-22	J. W. Stapp Constr. Co.-Praytor, Howton & Wood.
855	Mitchell	4.97	P. C.	174,393.78	4-17-23	Fisk-Carter Construction Co.
855B	Mitchell		Bridge	*22,699.85	8-22-22	Luten Bridge Co.
866	Polk	5.96	Bit Mac	180,393.40	11-21-22	Southern Paving Co.—Henry Constr. Co.

(*Final Cost)

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Completed—Continued

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	COMPLETED	CONTRACTOR
875	Rutherford		Bridge	*6,151.61	7-18-22	Geer & Wilson.
877	Rutherford	9.79	T. S.	64,563.73	8—7-22	Geer & Wilson.
878	Rutherford	6.55	T. S.	44,984.50	10-27-22	Michaux Const. Co.—Geer & Wilson.
879	Rutherford		Bridge	*6,781.99	6-21-22	Austin Bros. Bridge Co.
880	Rutherford		Bridge	24,679.43	3-23-23	Austin Bros. Bridge Co.
910	Cherokee	7.56	Gravel	76,743.59	2-24-23	Ross Bros. Constr. Co.—W. T. Moore Concrete Prod. Co.
942	Haywood	0.57	Gravel	*6,490.43	2—1-22	O'Brien Construction Co.

PROJECTS UNDER CONTRACT

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	CONTRACTOR
163 {F A 149	Nash	14.96	P. C.	409,592.40	Public Service Production Co.
329 {F A 155	Columbus	12.88	A. C.	422,462.60	Jas. L. Heyworth.
400A	Chatham		Grading	5,400.00	C. B. Hester (Fill).
485C	Wake	.51	Grading	10,452.00	Nello Teer (Fill).
835	Henderson	6.97	W. B. Mac.	281,162.75	J. B. Ross, Jr.—R. C. Stevens.
882B	Rutherford		Bridge	10,576.50	Michaux Contracting Co.

STATUS OF FEDERAL AID WORK IN NORTH CAROLINA

Projects Under Construction

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	BEGUN	CONTRACTOR
15	Guilford	4.205	Bit. Mac.	$ 5,441.75	9-1-17	County Commissioners.
61	New Hanover	2.186	P. C.	234,841.39	7-12-20	C. W. Lacy.
69	Transylvania	9.348	W. B. Mac.	231,409.04	3-25-20	Allport & Alexander Construction Co.
94A	Mitchell	5.04	W. B. Mac.	190,375.13	6-22-20	Gibson Construction Co.
125A	Alleghany	4.99	Bit. Mac.	153,899.13	11-22-21	W. E. Graham.

Summary

WORK UNDER CONTRACT

Type	STATE		FEDERAL AID	
	Length	Cost	Length	Cost
P. C.	14.96	$ 409,592.40		
A. C.	12.88	422,462.60		
W. B. Mac.	6.97	281,162.75		
Grading	.51	15,852.00		
Bridge		10,576.50		
Total	35.32	1,139,646.25		
WORK UNDER CONSTRUCTION				
P. C.	335.99	$ 11,029,239.57	2.19	$ 234,841.39
R. C.	67.92	2,433,241.08		
A. C.	284.31	9,144,806.89		
S. A.	20.90	243,332.08		
Bit. Mac.	51.40	1,248,598.28	9.19	159,340.88
W. B. Mac.	143.27	2,420,390.77	14.39	421,784.17
T. S.	375.45	2,818,514.01		
S. C.	165.19	1,223,871.84		
Gravel	190.53	1,834,431.71		
Graded	241.89	1,757,555.26		
Recon.	22.33	179,000.00		
Cord.	2.40	55,818.01		
Bridges		1,097,940.16		
Total	1,901.58	$ 35,486,739.66	25.77	$ 815,966.44

Summary—Continued

WORK COMPLETED

Type	STATE		FEDERAL AID	
	Length	Cost	Length	Cost
P. C.	24.08	965,965.87	26.56	889,940.67
R. C.	29.48	959,343.62	....	....
A. C.	96.20	2,725,515.60	42.29	1,521,368.25
S. A.	3.52	121,564.23	22.91	763,048.82
Bit. Mac.	16.36	380,393.40	30.62	798,895.02
W. B. Mac.	.99	22,350.24	14.00	303,505.78
Brick	9.50	217,405.72	....	....
T. S.	88.77	523,112.10	509.18	5,228,132.54
S. C.	22.25	82,289.69	83.90	785,198.22
Gravel	39.36	522,965.64	42.56	488.699.18
Graded	32.85	186,347.36	29.23	252,426.17
Recon.	43.20	89,966.25	....	....
Bridges	....	202,464.01	....	651,051.10
Total	406.56	6,999,683.73	801.25	11,682,265.75

Total Roadway Mileage 3,170.48. Total estimated cost of Roadway $54,162,270.06. Total estimated cost of Bridges $1,962,031.77. Corrected to May 1, 1923.

LEGEND

P. C.—*Plain Concrete. R. C.—*Reinforced Concrete. A. C.—*Asphaltic Concrete. S. A.—*Sheet Asphalt. Bit. Mac.—*Bituminous Macadam. W. B. Mac.—*Water Bound Macadam. T. S.—†Top Soil. S. C.—†Sand Clay. Gravel—†Gravel. Graded—†Graded. Recon.—†Reconstruction. Cord.—†Corduroy.

---

* Hard Surface. † "G" Type.

The Desert Road

THIS project runs through that vast territory of swamps, and flooded land known heretofore as the "Desert." On it there is a four-mile tangent, or a tangent clear across the "Desert." This road develops the major portion of Pasquotank County and with it one of the most fertile sections of country, for the desert is truly a fertile piece of land abandoned because of improper drainage and lying inaccessible between the swamps of Pasquotank River and the swamps of Little River. This project crosses tongues of Pasquotank River swamp in three places which drainage is well taken care of by double 4″ x 8″ culverts. It then traverses the "Desert" to Little River Swamp, which is taken care of by a 75′ bridge on conocrete piles.

The construction is 6″ reinforced concrete slab throughout, 1-2-4, concrete with construction joint bars and longitudinal rods, making each slab a unit bounded by a ¾″ steel rod, and well reinforced against longitudinal cracks by wire mesh. On this job the old-fashioned method of feeding the mixer by carts is used; the forms are of steel, and the mixer a "Rex," "Koehring Batchmeter," finishing "hand," or Bow Belt, and roller following standard screed board. This project is a daring feat, of a fearless Highway Commission, trying to develop a section often flooded, and building a road often covered by water and flood, and impassable a large part of the year. This will enable farmers to grow short, perishable crops, for now, the road will be passable at all times, and they have need for no fear that a flood will render the road impassable, and cause loss of their crops and labor. This and the drainage we are giving the road, and the drainage "District" being pushed into this section, and authorized by our Highway Commission, will make this one of the greatest developments in the history of road-building in North Carolina.

The Finest Road *in the* World—*and* What *it* Leads To

(Continued from page 9)

and which can be maintained at a reasonable rate, than to have three or four miles of a type which can be pointed to with pride because it is as smooth as a billiard table and in which the foundations and drainage structures and bridges, while no more serviceable, are the last word in road construction art?

What the public needs is good road service, and a lot of it. Is it not clear that the best expenditure of the public money will be made in securing the greatest amount of serviceable road mileage built on a basis of quality that will render an adequate return on the capitalized value of the road?

Cheap, flimsy construction that will require constant repair and replacement is an inexcusable waste, but so is the other extreme of attempting to build roads which, without continual care and a good maintenance policy, will last forever, because, as every highway student knows, there is no such thing as an everlasting road, unless it is made so by everlasting care and maintenance.

LITTLEFORD
:: TAR AND ASPHALT HEATERS ::

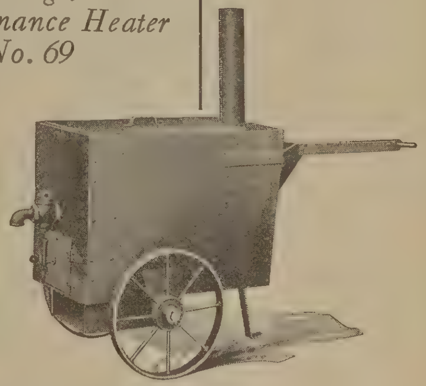
The most desirable equipment for contractors, municipalities, county and state highway departments for road and street construction and maintenance work.

Littleford Tar and Asphalt Heaters are durably constructed of heavy gauge steel, properly reinforced and compactly arranged to make handling and moving about a convenient and easy matter. They are made in various styles and different capacities to suit individual requirements.

Be assured of receiving dependable heater service by ordering Littleford Equipment. Our new catalogue of paving tools and equipment is now ready. A copy will be sent on request.

"Patrol" Heater No. 68

"Midget" Maintenance Heater No. 69



LITTLEFORD BROS.

STATE DISTRIBUTOR

E. F. CRAVEN, *"The Road Machinery Man"* **GREENSBORO, N. C.**

GROUND STORAGE is the Practical thing *for* ROAD BUILDERS

IT'S the thing that is coming into *wider and wider use* for the storage of construction materials, broken stone, sand, gravel, etc.

Ground storage piles require a minimum of permanent or semi-permanent equipment. You can build them at the railroad siding by a portable belt conveyor or a clamshell rig. You truck your materials to roadside storage and re-load to truck-tractor, truck or car to charge your mixers.

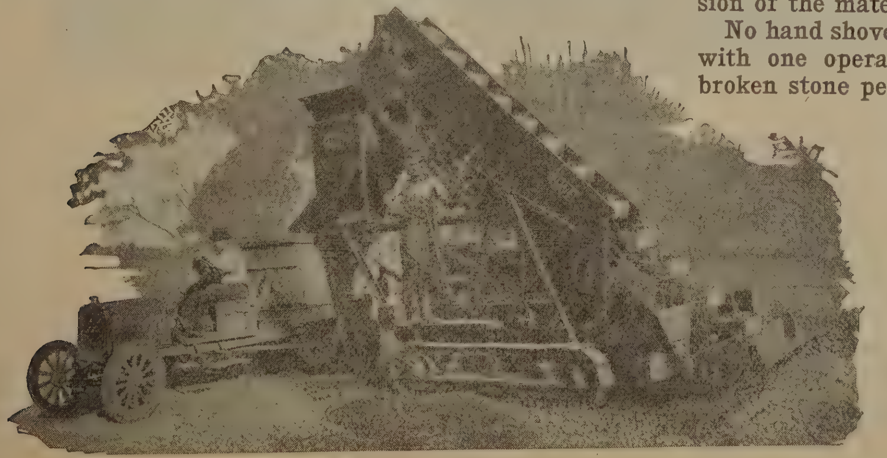
Roadside storage gives you a short haul to your mixer and keeps the material right in sight. If you put your truck in a long haul layout you're going to have the mixerman yanking on the whistle cord all the time.

Trucks get stuck, off the road—and the mixer waits.

The thing that makes this layout practical is the low cost of loading with Haiss Truck Loaders.

Haiss "Creeper" and "Path Digger" Loaders have been so developed that they clean up their own path as they load. They continuonsly "crowd" themselves slowly into the pile while digging. They have the patented Haiss Self-Feeding Device which digs into the pile and pushes the material into the path of the buckets. This action is positive—it does not depend at all on the adhesion of the material.

No hand shoveling—the machine does all the work and with one operator. Loads 1-1½ yards and more of broken stone per minute. Can be equipped with measuring hoppers for batch loading.



The George Haiss Manufacturing Co.
(Inc.)
Canal Place E. 143rd St. New York, N. Y.

INVESTIGATE!
Bulletin No. 123 has some real information in it. Ask for a copy.

Tractor & Machinery Sales Co.
1631 W. Broad St. Richmond Va.

"Standard" Paving Asphalt

has been successfully used on some of the most important highway projects in North Carolina.

This asphalt is refined from the straight Mexican asphaltic base petroleum, its purity being over 99.8%. "STANDARD" PAVING ASPHALT meets all the tests of a paving cement for asphalt concrete or sheet asphalt pavement, its uniformity and ability to resist extremes of temperature making it especially suited for these types of construction.

"STANDARD" PAVING ASPHALT has been used in practically every large city in the east.

STANDARD OIL COMPANY
(NEW JERSEY)

Baltimore, Md. Charlotte, N. C. Newark, N. J. Richmond, Va.

REFINERIES: Bayonne, N. J., Baltimore, Md., Charleston, S. C.

Steady Progress

Osgood 29-1 yd. on Highway Construction

The goal of every Contractor is to keep construction moving. The user of OSGOOD Steam Shovels is well on the way to uninterrupted progress. OSGOOD Steam Shovels are dependable—work day after day, keeping up the same large output. Watch an OSGOOD—check its mechanical features, its smooth and easy operation. A card will bring you an interesting descriptive Bulletin.

¾ and 1 yd. Revolving and 1½ to 6 yd. Railroad types.

The OSGOOD COMPANY
MARION, OHIO, U. S. A.

SLAUGHTER CULVERT COMPANY
300 - 301 MASONIC TEMPLE
RALEIGH

Metal Culvert *Concrete Culvert*

Washed and Screened
Sand Gravel Crushed Stone

Conforming to the specifications of the North Carolina State Highway Commission.

Prompt shipments by rail or water
Favorable freight rates to all North Carolina points.
Quotations gladly furnished on request.

THE ARUNDEL CORPORATION

MAIN OFFICE:
Pier 2 Pratt St.
Baltimore, Maryland

BRANCH OFFICE:
519 Board of Trade Bldg.
Norfolk, Virginia

ATTENTION

Mr. City and County Commissioner:

How about the Maintenance of your Asphalt Streets and Roads?

Investigate *now* the ANDRESEN ROAD REPAIR OUTFIT, so you will have the facts before you when your asphalt pavements begin to show the effects of heavy traffic.

The ANDRESEN ROAD REPAIR OUTFIT is a simplified portable plant for preparing hot asphaltic paving mixtures for repair work. Readily moved from one repair job to another, it has been found by City and County officials to be the most ECONOMICAL way of repairing asphalt pavements. "A stitch in time saves nine," and this old adage is especially true of asphalt road patch work. The investment for this outfit is small, and each year the Andresen outfit will show you handsome dividends on the investment, compared to costs of repair work by other methods.

Write for booklet entitled "MODERN METHODS FOR MAINTAINING ROADS and STREETS," and let us have our Paving Engineer call on you with full data on the ANDRESEN ROAD REPAIR OUTFIT.

E. F. CRAVEN

"The Road Machinery Man"

GREENSBORO, N. C. :-: STATE DISTRIBUTOR

Long Years *of* Life Ahead *of* Them

National Lock-Joint Cast-Iron Pipe

The Pipe *of* Short Units, Long Service *and* Low Costs

The Pipe that locks effectively, that prevents Separation and assures alignment to perfection.

The pipe which solves culvert renewal problems with least expense, greatest efficiency. The pipe that does not rot or disintegrate, the pipe that is mechanically correct and has proved itself the solution of the culvert problem.

CONTRACTORS *and* ENGINEERS, GET THIS:

TWO MEN, without the use of any tools whatsoever, will unload, handle and install all sizes up to and including 36 inches in diameter.

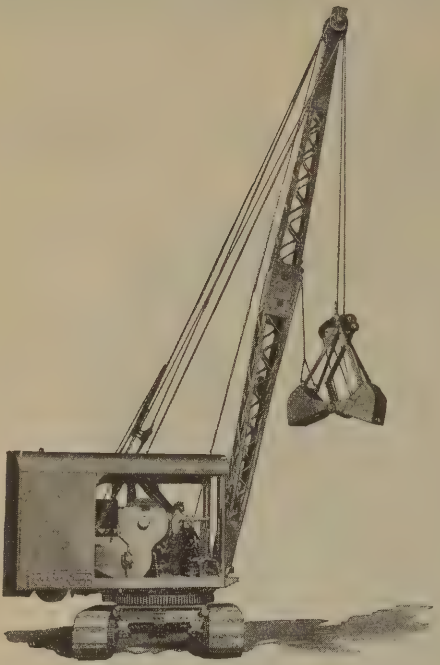
It is as cheap to handle and install as clay pipe WITH NO BREAKAGE LOSS. In shallow trench work the entire culvert can be built up, interlocked and rolled into place in one operation.

AMERICAN
CASTING CO.

Birmingham, - - Alabama

EARNEST

ROAD MACHINERY & CONTRACTORS' EQUIPMENT



Koehring Crane

TWO line speeds from two independently controlled drums. Change from dragline to clamshell work, merely by shifting a clutch! No gearing to replace. As quickly changed into power shovel—easily changed for pile driver and magnet.

A lever for every function

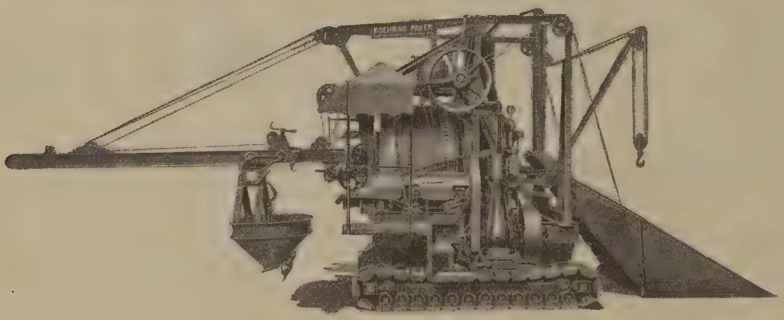
No double function levers. Combine any functions at will as a time-saving practice. The Koehring is designed for it. No penalty of excess wear.

Koehring "heavy duty" construction means the utmost of safety-margin against breakdowns and delays, the utmost of trouble-free service life.

No. 2 Capacity: 12 tons at 12′ radius, ½ yard clamshell bucket loaded with sand or gravel at 45′ radius. ¾ yard clamshell bucket loaded with sand or gravel at 39′ radius. 1 yard clamshell bucket loaded with sand or gravel at 33′ radius. 1½ yard clamshell bucket loaded with sand or gravel at 24′ radius. 1 yard Page drag bucket on a 40′ boom.

No. 3 Capacity: 20 tons at 12′ radius. 1 yard clamshell bucket loaded with sand or gravel at 50′ radius. 1½ clamshell bucket loaded with sand or gravel at 39′ radius. 2 yard clamshell bucket loaded with sand or gravel at 33′ radius. 1½ yard Page drag bucket at 40′ radius.

No. 1 Capacity: Equipped with 30′ boom. Handles ¾ yard bucket at 25′ radius; lifting capacity at 12′, 14,000 lbs. 4 cylinder 5″ x 6″ gasoline engine.



Koehring 21-E Paver

The product of mature Koehring leadership experience in the paving field and the outstanding inflexible Koehring policy of "Heavy Duty" construction. Wide skip 105", large Drum and Boom Bucket; Long Bearings, Heavy frame of expert design. Double gear drive, 3-point suspension multiplane.

Investigate Koehring carefully as to *dependability. Small amount spent on repairs* and the *Field Service* given by us, and you will standardize on it.

Blaw-Knox Forms

Made of 3/16" material *reinforced.* The strongest road form built. Only *two parts,* the form and the stake, as the wedges are cotter-keyed to the form. Easiest form set to line and grade.

Other Products

Blaw-Knox Truck Turntables, Steel Bins and Measuring Batchers, Clamshell Buckets and Steel Buildings for cement houses; Koehring Building Mixers, Bar Cutters and Benders; C. H. & E. Triplex Road Pumps; Jeffery Tanktred Loaders; Parsons Trench Excavators and Backfillers; Hoisting Outfits.

EARNEST BROS.

RICHMOND PHONES
MADISON 6460
MADISON 1381

805 E. FRANKLIN ST.
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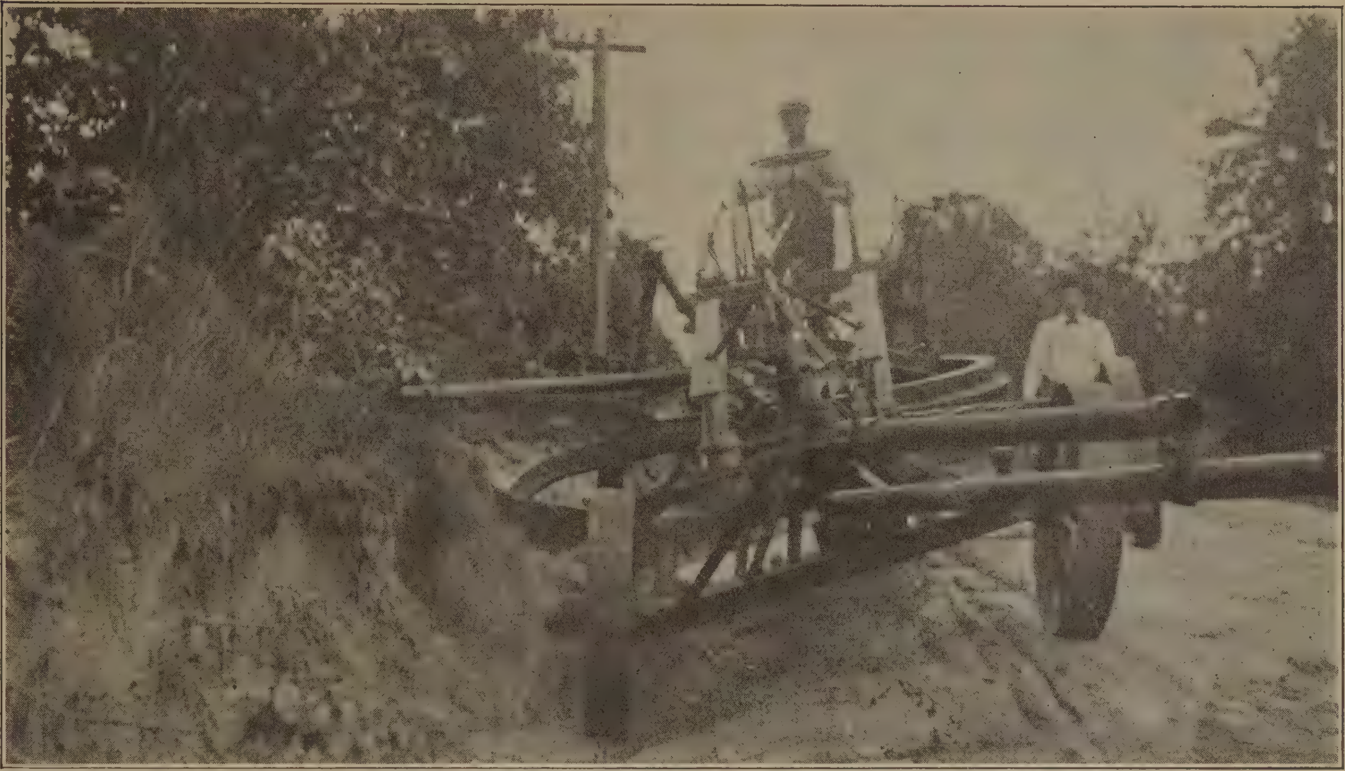
BRANCHES:
CHARLOTTE, N. C.
RALEIGH, N. C.

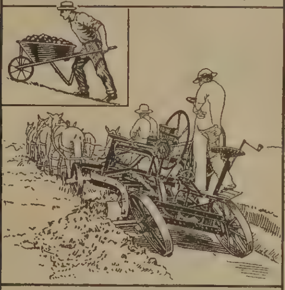
"Earnest Service by Earnest Bros."



One of the North Carolina State Highway Department's No. 12 Road King cutting down a rough ditch bank

in North Carolina

HE LEANS TOWARD THE LOAD



SO DOES THE ADAMS ADJUSTABLE *LEANING WHEEL* GRADER

ADAMS Graders have proved their superiority and their ability to build the most miles of Good Roads per dollar or per day. There's only one reason—the Adjustable Leaning wheels are an exclusive feature on Adams Graders by means of which the weight of Adams Graders is leaned toward and balanced against the load. This overcomes side-draft and skidding, increases capacity and lessens the draft. This feature also enables Adams Graders to do difficult ditch and bank work, not successfully accomplished with other graders.

Every Adams Grader is guaranteed to prove these claims. Write today for catalog and let us show you how Adams Graders will reduce your grading costs.

Adams Graders are built in 6½ ft. to 12 ft. blade lengths. There is a size to suit your needs and power exactly.

Write Our Local Distributor

J. C. BENJAMIN

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J. D. ADAMS & COMPANY

Home Office and Factory: INDIANAPOLIS, INDIANA

ADAMS ADJUSTABLE LEANING WHEEL GRADERS

CRUSHED STONE

for

CONCRETE PAVEMENT

for

TOPEKA OR WARRENITE SURFACING

for

CONCRETE BRIDGES

for

CONCRETE WORK OF ANY KIND

For Delivered Prices in Any Quantity
Wire, Write or Phone

ORINOCO SUPPLY CO.

WINSTON-SALEM, N. C.

The National Cement

LEHIGH
CEMENT

FOLLOWING closely the natural demand for cement, and offering advantages in the way of service and shipping facilities, are the sixteen great Lehigh mills stretching from coast to coast.

This nation-wide distribution makes Lehigh Cement readily available to practically any locality, thus insuring uniformity of material and prompt delivery to any job. Lehigh's square-deal policy is added assurance of satisfaction in the use of Lehigh—The National Cement.

16 MILLS FROM COAST TO COAST

LEHIGH PORTLAND CEMENT CO.
CHICAGO, ILL. ALLENTOWN, PA. SPOKANE, WASH.

NEW YORK CITY
BUFFALO, N. Y.
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IN twenty years Portland cement has advanced from comparative insignificance to the leading position in the construction material field. The ready adaptability of Portland cement to every kind of construction, from fence posts on the farm to gigantic dams and highways of endurance; the facility with which it can be handled; its durability which gives the highest degree of permanence, backed up by constant attention to perfection in manufacture and the most intelligent and comprehensive educative and advertising work that has ever been given to any building material, all combine to account for the remarkable progress achieved by the Portland cement industry. We take just pride in having always kept faith with the sound principles followed by this great industry.

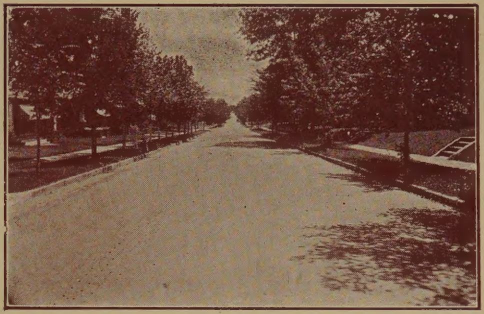
Every requirement for the manufacture of the high standard of quality laid down by the established scientific standard specifications is rigidly followed in making Clinchfield Portland cement. Service in the fullest meaning of the word is our watchword in dealing with our customers.

Builded upon this firm foundation of quality and service the Clinchfield plant has steadily grown and expanded and its products have been used with constant satisfaction for all classes of construction work in the South.

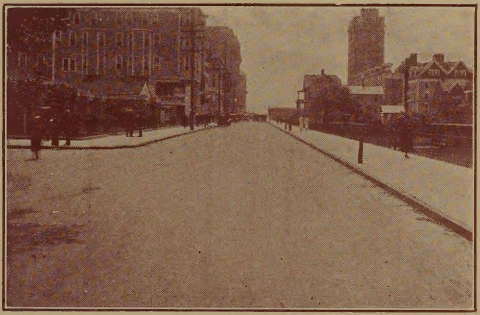
CLINCHFIELD PORTLAND CEMENT CORPORATION

Office and Mills: Kingsport, Tennessee

FOURTEEN-YEAR-OLD Texaco Asphaltic Concrete Pavement on Sixth Avenue, Newark, N. J.



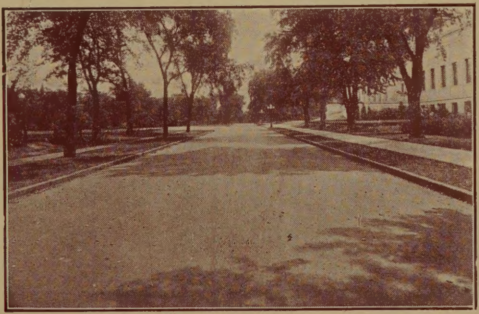
TWELVE-YEAR-OLD Texaco Sheet Asphalt Pavement on South Boston Avenue, Tulsa, Okla.



NINE-YEAR-OLD Texaco Asphaltic Concrete Pavement on New Jersey Avenue, Atlantic City, N. J.

NINE-YEAR-OLD Texaco Sheet Asphalt Pavement on Main Street, Houston, Texas

TEXACO ASPHALT Gives Ideal Pavements



SEVEN-YEAR-OLD Texaco Asphaltic Concrete Pavement on East 24th Street, Minneapolis, Minn.

Today TEXACO Asphalt pavements on every type of foundation from old macadam to cement concrete are carrying the traffic of six hundred American and foreign cities.

Minimum maintenance and long years of service are proved features of these pavements.

Perhaps there is no greater tribute to the quality of TEXACO pavements than that paid by the State of North Carolina.

In the State Highway System of this State alone, not including all county and city work, there are today well over a hundred miles of TEXACO Asphalt construction.

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Richmond
Boston
Jacksonville
Atlanta
New Orleans
Memphis

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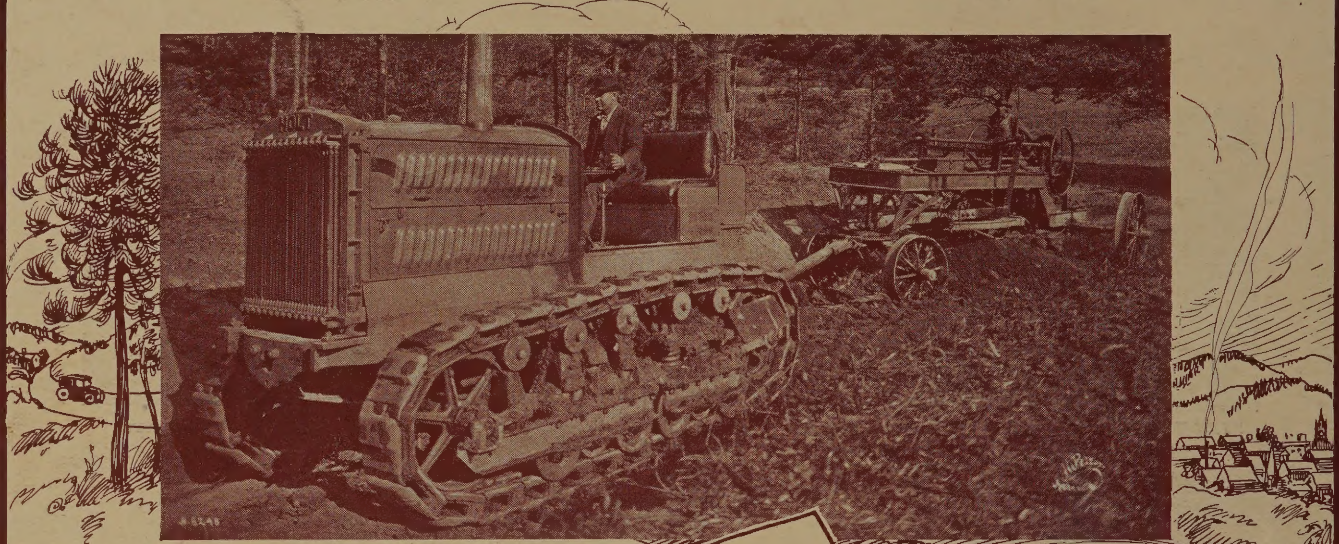
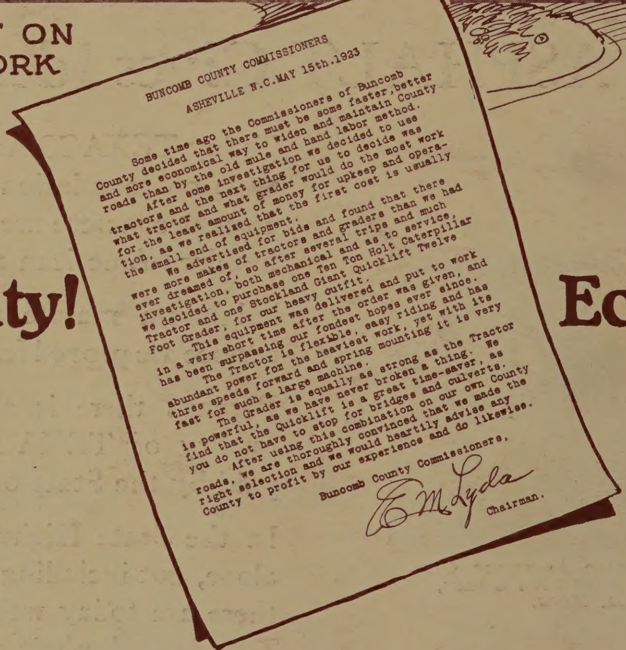


A REAL OUTFIT ON REAL ROAD WORK



BUNCOMB COUNTY COMMISSIONERS

ASHEVILLE N.C.MAY 15th.1923

Some time ago the Commissioners of Buncomb County decided that there must be some faster,better and more economical way to widen and maintain County roads than by the old mule and hand labor method.

After some investigation we decided to use tractors and the next thing for us to decide was what tractor and what grader would do the most work for the least amount of money for upkeep and operation, as we realized that the first cost is usually the small end of equipment.

We advertised for bids and found that there were more makes of tractors and graders than we had ever dreamed of, so after several trips and much investigation, both mechanical and as to service, we decided to purchase one Ten Ton Holt Caterpillar Tractor and one Stockland Giant Quicklift Twelve Foot Grader, for our heavy outfit.

This equipment was delivered and put to work in a very short time after the order was given, and has been surpassing our fondest hopes ever since.

The Tractor is flexible, easy riding and has abundant power for the heaviest work, yet with its three speeds forward and spring mounting it is very fast for such a large machine.

The Grader is equally as strong as the Tractor is powerful, as we have never broken a thing. We find that the Quicklift is a great time-saver, as you do not have to stop for bridges and culverts.

After using this combination on our own County roads, we are thoroughly convinced that we made the right selection and we would heartily advise any County to profit by our experience and do likewise.

Buncomb County Commissioners,

E M Lyda

Chairman.

Dependability! **Economy!**

Satisfaction!

There's Only One "CATERPILLAR" Holt Builds It